



METEOR REPORT

I. Observing Site:

- 1. (City, County, State):
2. (Latitude, Longitude, Elevation):

II. Time:

- 1. (Day, Month, Year):
2. (Time; local or UT?):

III. General Description:

- 1. Direction of travel: From to
2. Altitude when first seen
Altitude when last seen
3. Brightness (of head or largest object):
- Too bright to look at
- As bright as full moon
- As bright as star or planet
4. Length of time visible
5. If an explosion was witnessed, please describe:
How long was it visible after explosion?
Was it audible?
How long after it exploded did you hear it and for how long was it audible?
6. Was there a train of smoke, luminous path, or additional objects trailing the head?
7. Length (in degrees, if possible):
8. Color:

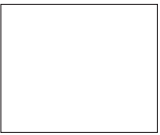
IV. Additional Description (If multiple objects, how many and what pattern? - please attach a sketch):

V. Miscellaneous Remarks:

Please, send your report to: Fireball Data Center / International Meteor Organisation (IMO-FIDAC) c/o André Knöfel / Am Observatorium 2 / 15848 Lindenbergl / Germany

OLAF NICOLA
WELCOME TO THE TEARS OF ST. LAWRENCE.
AN APPOINTMENT TO WATCH FALLING STARS.

A PROJECT COMMISSIONED BY TBA21 THYSSEN-BORNEMISZA ART CONTEMPORARY, ON INVITATION BY THE 51ST BIENNALE DI VENEZIA, 2005. COURTESY GALERIE EIGEN + ART LEIPZIG / BERLIN. FURTHER INFORMATION: WWW.TBA21.ORG



WELCOME TO THE
TEARS OF
ST. LAWRENCE
AN APPOINTMENT
TO WATCH
FALLING STARS.

POLARIS

CEPHEUS

GALACTIC EQUATOR

LACERTA

PERSEUS

TRIANGULUM

ARIES

PISCES

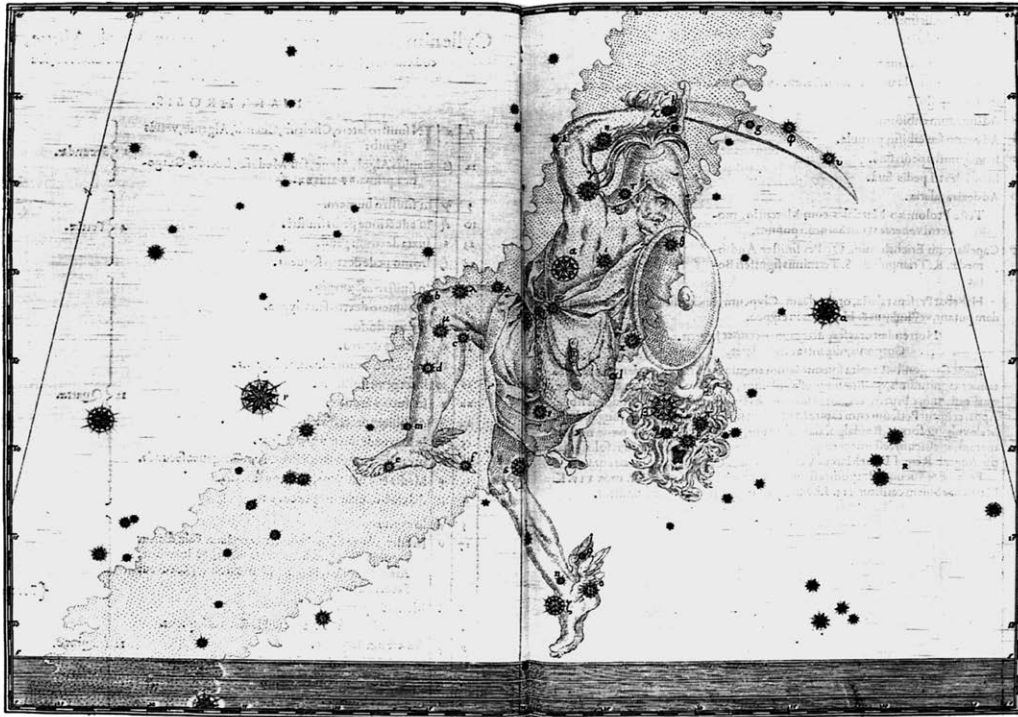
ANDROMEDA

ECLIPTIC

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In the early hours after midnight, between the 9th and 13th of August, watch the Northern sky facing Northeast, in the direction of the constellation of Perseus, which you will find in the sky at an angle of approx. 45° up from the horizon. Look out for a shower of falling stars. They are the ›Tears of St. Lawrence‹.



The Perseus constellation. From: J. Bayer, Uranometria (1603)

The Perseids

The Perseids are one of the most remarkable of the yearly meteor showers. The stream starts in late July and lasts until mid-August. It reaches its peak of activity between August 9 to 13 with a rate of up to 80 meteors per hour. In the first three weeks, the meteors are particularly bright and numerous because the Earth passes through a broad stream of particles behind the comet Swift-Tuttle 1862 III. The Perseids reach the atmosphere with a velocity of ca. 60km/s. They are named after their radiation point, the Perseus constellation.

Perseus: Myth and Constellation

The Perseus constellation consists of numerous celestial objects and 10 main stars. In the Greek myths Perseus overcame the monster Medusa. Everyone who looked at Medusa was turned to stone. Perseus observed her in the reflection of his polished shield and decapitated her with a single thrust of his sword. Afterwards, Perseus rescued Andromeda. Perseus can be seen in the heavens next to Andromeda, in his hands are the sword and the head of the Medusa.



Detail from: Titian, The Martyrdom of St. Lawrence (1564-67)

The ›Tears of St. Lawrence‹

This name is given to the Perseids in honor of the martyr of St. Lawrence. His commemoration day is August 10, which is close to the day of their maximum. When Lawrence attempted to follow Sixtus II to his execution (258 A.D.), the pope gave him the task of distributing the treasures of the church to the needy. He comforted Lawrence with the promise that he would follow him in three days. Emperor Valerian claimed the treasures for himself. Lawrence asked for three days time, then summoned those who had been healed and those who had converted to Christianity and referred to those present as the real riches of heaven. Consequently, the angry emperor had Lawrence tortured, in order to force him into the service of the heathens. When Lawrence remained resolute, Valerian commanded that he be roasted to death over the fire. The meteors are seen as the Saint's fiery tears. Lawrence is designated by the gridiron on which he was martyred. The monastery and palace El Escorial in Spain was built (1563-84) for Philip II and dedicated to St. Lawrence, on whose day in 1557 the Spaniards defeated Henry II of France. The immense structure (207 m × 161 m) is shaped to resemble the grid of St. Lawrence.

Observing the Perseids

The observation of the Perseids started more than 1,900 years ago. They were first seen in China on July 17 in the year 36 A.D. The next documented return took place towards the end of July in 714 A.D., and since then there have been many reports. The Perseids were probably first recognized as a strong, yearly meteor shower around 1835. The fundamental research was performed by the astronomer, L. A. J. Quételet (1796–1874). Between 1864 and 1866 G. V. Schiaparelli (1835–1910) calculated the orbit of the Perseids' stream and discovered that they are practically identical with the periodical comet Swift-Tuttle. It was the first mathematical proof of the connection between a meteor shower and a periodically appearing comet. In 2021 the Perseids reached their maximum peak of activity on August 12 (19:30 Universal Time^{*}). In 2022 the peak is expected on August 13 (09:30 UT).

Universal Time

Universal Time (UT)^{} is a time standard used by astronomers. Observations are reported in UT. To convert UT to local time, take UT and add the given time. For areas using daylight savings time: add 1 hour.

International Date Line East (IDL_E) **+12 hours** / New Zealand Standard Time (NZST) **+12 hours** / New Zealand Time (NZT) **+12 hours** / Guam Standard Time (GST) **+10 hours** / East Australian Standard Time (EAST) **+10 hours** / Japan Standard Time (JST) **+9 hours** / China Coast Time (CCT) **+8 hours** / West Australian Standard Time (WAST) **+7 hours** / India Standard Time (IST) **+5,5 hours** / Russian Zone 3 **+4 hours** / Baghdad Time (BT) **+3 hours** / Russian Zone 2 **+3 hours** / Eastern European Time (EET) **+2 hours** / Russian Zone 1 **+2 hours** / Central European Time (CET) **+1 hour** / Middle European Time (MET) **+1 hour** / Swedish Winter Time (SWT) **+1 hour** / Greenwich Mean Time (GMT) **0 hours** / Universal Time (UT) **0 hours** / Western European Time (WET) **0 hours** / West African Time (WAT) **-1 hour** / Atlantic Standard Time (AST) **-4 hours** / Eastern Standard Time (EST) **-5 hours** / Central Standard Time (CST) **-6 hours** / Mountain Standard Time (MST) **-7 hours** / Pacific Standard Time (PST) **-8 hours** / Alaskan Standard Time (AKST) **-9 hours** / Hawaiian Standard Time (HST) **-10 hours** / International Date Line West (IDL_W) **-12 hours**.

For further information contact: www.comets.amsmeteors.org

Glossary

Aphelion

The point in the path of a body of the solar system that is farthest from the sun. All such bodies move on elliptical paths around the sun.

Asteroids

Small planets or planetoids with a diameter of less than 1 to about 1,000 kilometres, which move mainly on orbits between those of Mars and Jupiter. The first asteroid was discovered by Giuseppe Piazzi in 1801.

Astronomical Unit (AU)

The mean distance from the centre of the Earth to the centre of the sun (149,500,000 km).

Atmosphere

consists of 5 layers. Comets, meteorites, space dust and other objects burn up due to friction in the mesosphere. The layers are:

Troposphere: closest layer to Earth, contains weather, clouds, smog, 75% of all of the Earth's gases, dust, ice, water

Stratosphere: little temperature variation throughout the stratosphere, converts oxygen into ozone, ozone protects from UV rays

Mesosphere: melts meteors, space dust

Thermosphere: contains ionosphere, ionosphere reflects radio waves at night, absorbs them during the day

Exosphere: hydrogen and helium molecules escape from the exosphere into outer space.

Canterbury Swarm

In June 1178, monks of the Canterbury Abbey observed the impact of a meteorite swarm on the moon. It was verified by the Apollo missions of 1972–77 (an impact crater 20 kilometres wide, found in the Giordano Bruno formation). There has repeatedly been speculation as to a connection between the swarm and the Tunguska explosion of 1908. The swarm's next approach to the Earth will be in June 2042.

Comets (ill. N° 01)

The word derives from the Latin term *cometa* and Greek *komētēs*, meaning *long-haired* (from *kómē*, i.e. *hair, mane*). Small objects of the solar system (a few kilometres in diameter), consisting mainly of ice and some space dust, for this reason also described as *dirty snowballs*. They belong to the outer solar system and are found in the 'nearby' Edgeworth-Kuiper Belt (just outside the orbit of Pluto) and the 'distant' Oort Cloud. Only about 4 percent of all known comets return periodically (such as Halley's Comet). The ancient Romans believed comets to be the cause of natural disasters. Pliny (23–79 A.D.) assigned twelve different forms of comets to various natural catastrophes. During the Middle Ages, Christianity considered comets to be signs sent by God. In 1066, Halley's Comet was interpreted as a portent of the Norman conquest of England, and therefore depicted in the Tapestry of Bayeux.



Constellations

The system of constellations that we use today is the product of a table of 48 constellations that Ptolemy published in the year 150 B.C. (*Almagest*).

Since then, astronomers have filled the gap between the figures of Ptolemy and the region around the South Pole that was beneath the horizons of the ancient Greeks. Today, we know exactly 88 constellations by international accord.

Cults and Fallen Meteors

Meteors and meteorites have often been the cause for the founding of places of worship. Plutarch writes of a black stone said to have fallen in Phrygia around 470 B.C. The meteorite was worshipped in the name of the goddess Kybele. The Romans took it to Rome in a large procession (204 B.C.) and worshipped it in the cult of Magna Mater Deum Idea. The Temple of Artemis at Ephesus contained a sacred stone that had *fallen from Jupiter*. Also the black stone (Hadschar al-Aswad) in the central sanctuary of Islam, the Kaaba in Mecca, is possibly a meteorite.

Deep Impact (ill. N° 02)

The NASA mission *Deep Impact* was named for the Hollywood movie of the same name (*Deep Impact*, 1998, dir. Mimi Leder) which tells the story of



an impending collision of Earth with a cosmic object. On July 4, 2005, the probe successfully reached the interior of the nucleus of comet Tempel I. It consists of an orbiter which turns into an 'orbit' around the comet, and a so-called impactor. The latter's collision with the comet blasts fragments of ice and dust off it, as well as lower strata of material, which scientists will study as the basic building blocks of our solar system.

Disaster

The word comes from the French désastre, from *astre*, i.e. *celestial body*, in Greek *astér* for *star*, *heavenly body*. Coined on the basis of the belief that certain constellations of celestial bodies determine the fate of man. Hence the idioms *unlucky star* and *lucky star*.

Dragons and Giants

In folklore, meteors and meteorites are connected with numerous fables: Unexplained fires were taken as evidence that dragons once lived in those places and had now suddenly returned. In Germany these were known as *Heerbrand*, which also refers to meteor impacts in the vernacular language. In the upper palatinate there are also stories about giants roaming the land. A giantess was combing her hair with the crescent of the moon and the people recognized the falling stars as the sparks she produced. Throughout history, people saw meteors as objects made of gold or silver that were placed in the heavens as star money, or diamonds or toys for deceased children. Falling stars could equally indicate a change from good luck to bad luck. If a star falls from heaven, then someone dies. If there is a new star in the night sky, someone is born.

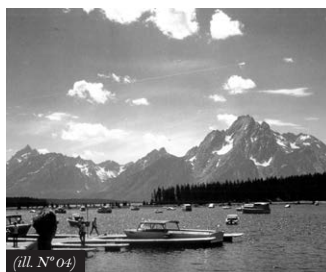


Falling Star (ill. N° 03+05)

Seeing a meteor, people believed that a piece had been cleaned away from the stars. The German *Sternschnuppe* is derived from the medieval root *snuppen* that means *to clean*. *Schnuppe* refers to the carbonized end of a candlewick that means *to ground* when cleaning tallow candles. For the Greek comedy writer, Aristophanes (ca. 448-385 B.C.), shooting stars were the souls of poor men, who staggered drunkenly from the host on the way home.

Fire Ball (ill. N° 04)

A very bright meteor caused by extra-terrestrial matter ranging from centimetres to metres in size. These meteoroids fall with the appearance of a fireball. One of the most conspicuous fireballs was observed on August 10, 1972. It was easily observable on a bright day. The object with a diameter of ca. 13m and a weight of 4.000 tons flew from Utah (USA) over Jackson Lake, Wyoming in a northerly direction. It entered the atmosphere around Beaver, Utah and approached the Earth over Montana at an altitude of 58 km. After having covered a distance of 1.500 km in 101 seconds, the fireball



left the airspace over Alberta between Calgary and Edmonton.

Flash of Light

In September 1979, an American satellite registered two flashes of light that resembled an explosion in the western Indian Ocean and the southern Atlantic Ocean. The energy level was equivalent to that of one sixth of the bomb dropped on Hiroshima. It was suspected to be the result of a secret test of an atomic weapon from South Africa or Israel. Later, tests indicated that there were no increases in the level of radioactivity, so that it could be assumed that the light was caused by a meteorite.

Gorath (ill. N° 06)

A Science-Fiction movie from 1962 (dir. Ishiro Honda). The film is set in 1982 and is an early example of a film based on the idea that a giant meteoroid is on a collision course with Earth.



Hale-Bopp

On November 14, 1996, the amateur astronomer, Ch. Shramek, took a picture of the comet Hale-Bopp, in which he thought he saw a *Saturn shaped object* in the proximity of Hale-Bopp that he could not explain. He posted the photo, along with his question as to what the unusual object might be, on the Internet. On March 26, 1997, 21 women and 18 men, who were members of the *Heaven's Gate* cult, poisoned themselves in San Diego. They suspected a space ship in the shadow of the comet, which would open the gates to heaven for them for the last time before finally closing.

Halley

In 1705, the English astronomer, E. Halley (1656-1742) published his most famous work (*Synopsis of Cometary Astronomy*) with the calculation of the orbits of 24 comets. He predicted the return of a comet in the year 1759. It was subsequently named after him. He made a significant contribution to transferring meteors from the realm of meteorology to astronomy, when the comet appeared according to his predictions.

Hoba (ill. N° 07)

The meteorite Hoba was discovered in 1920 by J. H. Brits on the Hoba Farm, in Grootfontein, Namibia. The impact is assumed to have occurred about 80.000 years ago. It has a volume of 9 cubic metres and a weight of 50 to 60 tons. It is estimated to be between 190 and 410 million years old. Since 1955, the meteorite is a national monument.



Mrs. Hodges

This is the only proven case of an injury caused by a comet. On November 30, 1954, a meteorite that weighed

about 4 kg, crashed through the roof of Mrs. Hodges' house in Sylacauga, Alabama, bruising her hand and buttock.

Impact (see Table 2)

There are seven hundred to one thousand objects orbiting near Earth that are greater than one kilometre in diameter. The impact of an object that large would deliver fifty times the maximum possible destructive power of a global nuclear war. Some astronomers believe that there is a long-term cycle of fifteen to thirty million years for impacts. Others believe the fluctuation of impacts varies on an even more frequent cycle.

KT-Event

A crater with a diameter of 180 kilometres was created by the impact of a meteoroid (KT-Event) about 65 million years ago in Chicxulub, Yucatán (Mexico). It is supposed to have extinguished the dinosaurs and many other species of animals.

Language is a Virus from Outer Space

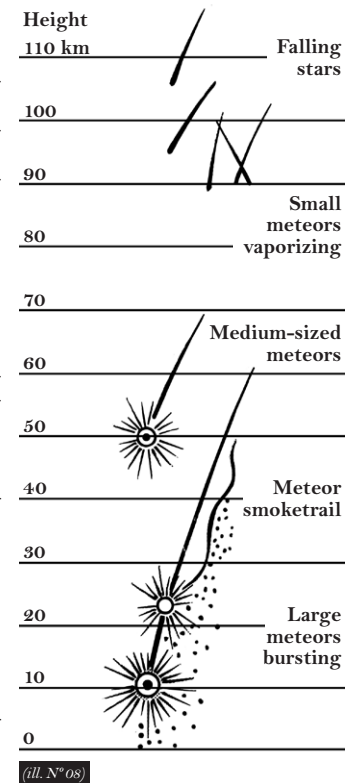
A theory developed by William S. Burroughs (among others) stating that the word began as a biological virus that altered the throat structure of pre-historic protohumans. Burroughs believed that this unique virus was of extraterrestrial origin. Those who survived passed the virus on to their descendents. Thus the originally biological virus had mutated into the first information virus, the primogenitor of the computer virus.

Leonids

The Leonids are a meteor shower that occurs every year in mid-November. The meteors are termed Leonids because their radiant point is the constellation Leo. The Leonids are the product of the comet Tempel-Tuttle (which can be seen every 33 years). On November 13, 1833, in North America the Leonids caused hundreds of thousands of lightning bolts that tore people out of their sleep. The event inspired E.A.Poe (1809-49) to write *The conversation between Eiros und Charmion*.

Meteor (ill. N° 08)

Meaning *floating in the air* in its Greek origin, this term refers to a meteorite that ignites upon entering the atmosphere and thereby generates light. Aristotle (384-322 B.C.) believed that it had only to do with purely atmospheric phenomena: Fire in the air, steam that rises from the ground and slowly burns out. Even until the late eighteenth century, many physicists dismissed the falling stones as fairy tales or superstition. Only with the publication of scholarly works between the years of 1794 and 1803 has the cosmic origin of stones been accepted as theory.



(ill. N° 08)

Meteor Shower (see Table 1)

Meteor showers (meteor streams) consist of clouds of meteoric dust. These particles have a path, which is different from that of the comet. They generate a dense cloud in front of and behind the core of the comet.

Meteorite

A meteor, which has failed to burn up completely, and has reached the Earth and impacted there.

Meteoroid

An object from interplanetary space with course for the Earth, where it will produce a meteor and perhaps also a meteorite (or micrometeorites). These objects are usually smaller than an asteroid and larger than a molecule (ca. 0.000 000 010 - 1.000 m).

Names of Comets

Towards the end of the nineteenth century, the following system was established for naming comets: They are designated in the order of their appearance in the current year (1963 I, 1963 II, etc.). If it concerns a comet that is already known, that name will be added. If it is a *new* comet, it receives the name of its discoverer. If the same person discovers multiple comets, the name of the discoverer is followed by a Latin numeral that indicates its order.

Niningerit

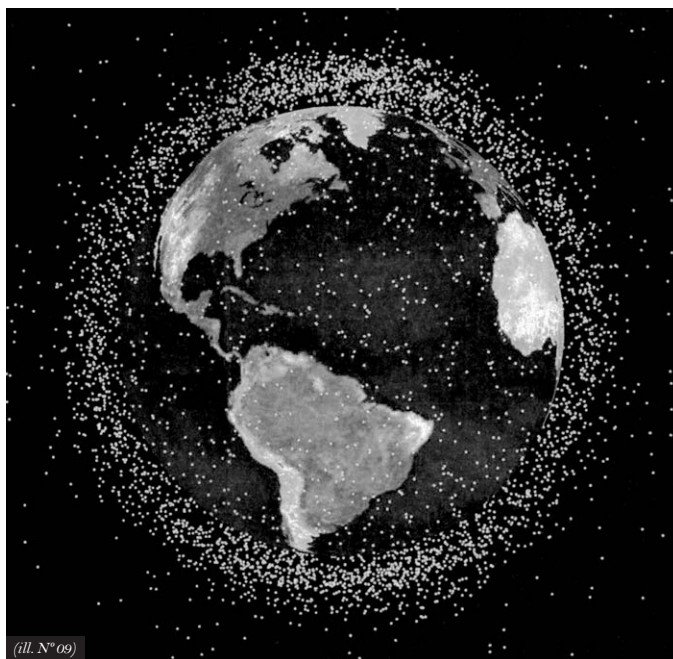
The name of an element, which previously had not been found on Earth and exists only in meteorites.

Non Cooperative Objects (ill. N° 09)

The U.S. military follows the orbits of about 9.000 objects that are at least 10 cm long and therefore capable of being detected by telescopes and radar systems. Only 6% of these objects are dedicated satellites, the rest is junk. In addition to the fragments that are at least 10 cm long, there are 330 million smaller objects. Professionals denote them as *non cooperative objects* because they cannot direct themselves.

Nova Telluris Theoria

Theory published in 1696 by the theologian and mathematician William Whiston. He believed that comets were the cause of every terrestrial change. According to his theory, even the Earth was originally a comet. Another comet hit the equator and set the Earth in motion, a second comet



(ill. N° 09)

drowned the Earth in its trail (causing the biblical Flood). Finally, a third comet will cause the end of the world, pushing the Earth closer to the sun and thereby causing thousand years of hell. Following this time the cycle starts anew. After the collision with the fourth and last comet, the Earth will tumble back into the original orbit.

Oort Cloud

A spherical cloud of comets that envelopes the solar system, probably with a radius of about 200.000 Astronomical Units (AU). It lies on the external boundary of the solar system. It is possible that there are more than 1 billion comets in this cloud with an average diameter of several kilometres. A disturbance of any kind could release a number of objects from the cloud, which would then strike a very long and narrow elliptical course to the sun. This probably occurred 2.000 years ago and led to the stream of bright comets that was recorded in the fifteenth and sixteenth centuries.

Panspermia

The theory, according to which the origin of life is suspected to be prevalent throughout the universe, from where it was brought to Earth through cosmic dust or meteorites. Pandemics (e.g. flu epidemics) are explained in this manner. Today the theory is not very popular.

Perihelion

The point in the orbit around the sun that is nearest to the sun. All planets revolve around the sun in an elliptical orbit.

Radiation Point

The point in the sky, from which the meteors of a shower appear to emanate. It is usually indicated by its coordinates in right ascension and declension. The meteor showers are usually named after the constellation in which the radiant appears.

Spacewatch

The name of a special search and defense system for potentially dangerous objects that was prompted by the

Earthcrosser-Icarus-Study (1967). In this study a research group from Massachusetts Institute of Technology (MIT) described on occasion of the expected approach of the asteroid *Apollo* (June 14, 1968) the results of a crash of a 30 metre high tidal wave on every coast.

Star-Jelly (Tremella nostoc)

(ill. N° 10)

Type of algae which was thought to be a fallen star due to its shape and gelatinous consistency. It was believed that falling stars were waste products resulting from cleaning the stars. In Estonian legends, *Tremella nostoc* is used as food for the *Dogs of St. George*. These dogs are wolves, in which the souls of those who commit suicide must live in order to be redeemed. They are fed by the Saint once per month. The wolves wait on their backs with open mouths for the food to fall from heaven.



(ill. N° 10)

Stowaways

Beside amino acids and carbohydrates, fullerenes and even diamino acids have been detected in meteorites. These discoveries support theories that some essential elements of life came to Earth by means of meteorites. In further support of this theory, scientists often refer to the *Streptococcus mitis* bacteria which survived in the material of the Surveyor probe on the moon for two years (1967-69) under extreme conditions (temperatures between -160° and +130° Centigrade and low pressure).

Superman (ill. N° 11)

Clark Kent, also known as the hero *Superman* (1948, dir. Spencer Benett, Thomas Carr) from the fictional planet Krypton, arrived on Earth as an infant inside a meteorite.



(ill. N° 11)

Tools (ill. N° 12)

It was possible to produce metal tools and weapons from the material of meteorites even before the technique of producing iron had been established. The heavenly origin of the special material emphasized the cultic reverence of such objects. In the collection of the British Museum of London is a dagger from the grave of Tutanchamun (3.000 B.C.) made of meteor stone.



(ill. N° 12)

Torino Scale

This scale is a method for categorizing the impact hazard associated with asteroids and comets. It uses a scale of numbers from 0 to 10.0 indicates an object has a zero or negligible chance

of collision with the Earth. 10 indicates that a collision is certain and that the impacting object is so large that it is capable of precipitating a global climactic disaster.

Tunguska Event (Russia) (ill. N° 13)

On June 30, 1908, witnesses reported seeing a light blue ball of fire. Shortly afterwards, a shock wave destroyed a 2.000 square kilometre forest. The resultant changes in air pressure were even registered in London. There are a number of theories (see *Canterbury Swarm*) about the cause. Meteorites that might have caused the occurrence have not been found to this day.



(ill. N° 13)

Wish Fulfillment

In ancient Europe, it was thought that the gods sometimes took a look at the Earth out of curiosity from between the spheres and in that instant a star or two might slip through the gap and become visible as a falling or shooting star. Since the gods were clearly peering down, it was considered an excellent opportunity to voice one's wishes with a greater likelihood that the gods might hear them. In different regions, wish fulfillment is bound to certain habits. In Europe, the wish must be spoken softly to oneself and not communicated to anyone else. In Latin America, especially Chile, one must raise a stone at the same time. In Oceania, in the Philippines, the legend instructs people to tie a knot in a handkerchief.

Table 1 & 2

List of Meteor Showers (2005)

Night Shower	Activity Period		Maximum		Radiant		Velocity km/s	r	ZHR*	Comet
	Date	S.L.	Date	S.L.	R.A.	Dec.				
Quadrantids (QUA)	Jan 01-Jan 05	Jan 03	283°16'	15:20	+49°	41	2.1	120		
Lyrids (LYR)	Apr 16-Apr 25	Apr 22	032°32'	18:04	+34°	49	2.1	18	1861 I	
Eta Aquarids (ETA)	Apr 19-May 28	May 05	045°5'	22:32	-01°	66	2.4	60	Halley	
June Bootids (JBO)	Jun 26-Jul 02	Jun 27	095°7'	14:56	+48°	18	2.2	var	Pons-Winnecke	
South Iota Aquarids (SIA)	Jul 25-Aug 15	Aug 04	132°	22:16	-15°	34	2.9	2		
Perseids (PER)	Jul 17-Aug 24	Aug 12	140°	03:04	+58°	59	2.6	100	1862 III	
Giacobinids (GIA)	Oct 06-Oct 10	Oct 08	195°4'	17:28	+54°	20	2.6	var	Giacobini-Zinner	
Epsilon Geminids (EGE)	Oct 14-Oct 27	Oct 18	205°	06:48	+27°	70	3.0	2	Halley	
Leo Minorids (LMI)	Oct 23-Oct 25	Oct 24	211°	10:48	+37°	61	2.7	2		
Southern Taurids (STA)	Oct 01-Nov 25	Nov 05	223°	03:28	+13°	27	2.3	5		
Northern Taurids (NTA)	Oct 01-Nov 25	Nov 12	230°	03:52	+22°	29	2.3	5		
Leonids (LEO)	Nov 14-Nov 21	Nov 17	235°27'	10:12	+22°	71	2.5	20+	Tempel (1866 I)	
Alpha Monocerotids (AMO)	Nov 15-Nov 25	Nov 21	239°32'	07:48	+01°	65	2.4	var	Biela	
Geminids (GEM)	Dec 07-Dec 17	Dec 14	262°2'	07:28	+33°	35	2.6	120	Planetoid Phaeton	
Ursids (URS)	Dec 17-Dec 26	Dec 22	270°7'	14:28	+76°	33	3.0	10	1939 X	
Day Shower										
Tau Cetus (CET)	Jun 18-Jul 04	Jun 27	096°	01:36	-12°	66	2.5	4		
September Perseids (SPR)	Sep 05-Sep 16	Sep 09	166°7'	04:00	+47°	64	2.9	5		
Eta Lyrids (IAA)	May 05-May 17	May 09	049°	19:12	+44°	44	2.5	3		
Tau Aquarids (TAQ)	Jun 19-Jul 05	Jun 29	098°	22:48	-12°	63	2.5	3	Encke	

* ZHR = meteors/h

Consequences of Meteors, Meteorites and Impacts

Impactor Diameter (meters)	Yield (megatons)	Interval (years)	Consequences
<50	<10	<1	meteors in upper atmosphere; most don't reach surface
75	10-100	1.000	stones produce airbursts like Tunguska; land impacts destroy area size of city (Heidelberg, Florence)
160	100-1.000	5.000	irons, stones hit ground; comets produce airbursts; land impacts destroy area the size of large urban area (New York, Tokyo)
350	1.000-10.000	15.000	land impacts destroy area the size of small state; ocean impact produces mild tsunamis
700	10.000-100.000	63.000	land impacts destroy area of a moderate-sized state (Virginia); ocean impact causes big tsunamis
1.700	100.000-1.000.000	250.000	land impact raises dust with global implication; destroys area size of large state (California, France)

Links

WEB

Meteorites:

www.meteor-center.com
www.meteorites.de/index.htm
www.meteoriticalsociety.org
www.meteoroids.de/swiss_met_a.htm

Impacts:

www.barringercrater.com
www.pibburns.com/catastro.htm

Calendar:

<https://www.amsmeteors.org>
<https://www.imo.net>

ESA:

www.esa.int/Space_in_Member_States/Spain

Meteorites for sale:

www.meteorite-martin.de
www.meteorites.com
www.meteoritemarket.com
www.michaelbloodmeteorites.com
www.meteorites.tv
www.arizonaskiesmeteorites.com
www.catchafallingstar.com
www.geoterra.es/39-meteoritos

Mineralogy:

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Colophon

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