METEORITES, METEORS AND SHOOTING STARS

By FREDERIC A. LUCAS
Revised by CHESTER A. REEDS

SECOND EDITION

GUIDE LEAFLET No. 64
THE AMERICAN MUSEUM OF NATURAL HISTORY
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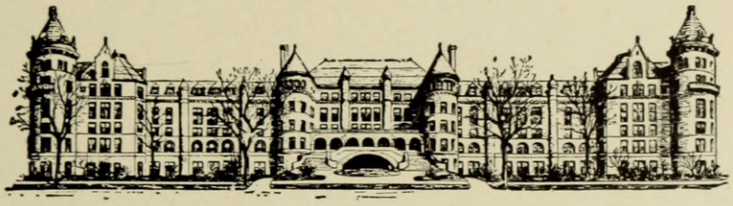

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NEW YORK, 1931

THE WILLAMETTE METEORITE.

The largest meteorite so far found in the United States and the most interesting yet discovered.
Gift of Mrs. William E. Dodge, 1906.

METEORITES, METEORS AND SHOOTING STARS

BY FREDERIC A. LUCAS

When the Willamette Meteorite was brought to the Museum, the attendant in the hall where it was placed was the recipient of many inquiries from interested visitors who wished to know what the (then) unfamiliar object was. Finally, in self defense he placed on it a card: "This is a piece of a star," a statement which if not strictly accurate was one that embodied the most information in the fewest possible words. And if sticklers for accuracy complain that this is a very incorrect definition they may be reminded that it is not nearly so misleading as that of the chemist Lavoisier who, so late as 1772, reported on a specimen submitted to a committee of the French Academy, that it was only a common stone that had been struck by lightning. For those who wish a brief and authoritative statement as to what meteorites are, one cannot do better than quote from the general label on the meteorites, a label read daily by scores of visitors and an admirable refutation of the mis-statement that visitors won't read long labels—they will, provided the subject is of interest and the label well-written.

To borrow from Dr. E. O. Hovey, meteorites, as we know them, are bodies of iron or stone, ranging in size from particles of dust up to masses of 30 tons weight, that circle through space like little planets. Ordinarily they are too small to be seen, but when they enter the earth's atmosphere, as thousands of them do daily, become visible through being made hot from the friction of the air. The small meteorites burn up when far above the earth and are the familiar "shooting" stars; the larger masses, known as meteors during their glowing passage through the air, often reach the earth as meteorites. These falls are accompanied by dazzling light and usually, or often, by violent explosions, due to the breaking up of the mass, and so loud that they have been heard at a distance of sixty to one hundred miles.

The molten particles given off by meteors as they hurtle blazing through the air fall like rain in the form of minute drops, and when this occurs over the ocean these particles sink to the bottom, and at great depths, where, not disturbed by currents, this cosmic dust, as it was termed by Sir John Murray, has in time accumulated in places to form a perceptible, if small, portion of the ocean floor.

Where do meteorites come from? What is their origin? This is something of which we are quite ignorant, though there are some plausible theories concerning them and others not so plausible. Perhaps the most favored explanation was that meteorites were ejected by volcanoes

variously located according to the imagination of the theorist, on the earth, the moon or the sun.

As for their earthly origin it was shown that to get them outside the attraction of the earth they must be cast forth with a speed of five miles a second, a much greater explosive force than shown by any volcano, even Krakatoa. The lunar volcanoes have long been extinct and if they were the source of meteorites these must have been ejected ages ago.

In direct opposition to the theory that meteorites *came* from the moon, Mr. Grove K. Gilbert advanced the hypothesis that the vast, circular, low-walled craters with which the moon's face abounds might have been caused by the impact of huge meteorites falling on the luminary.

The view, then beginning to be seriously considered, that the Coon Butte Crater (Arizona) was created by a giant meteor may have led Gilbert to consider this theory, but while he showed that there were good arguments in its favor he abandoned it in favor of the theory that the lunar craters were formed by the fall of "moonlets" that had circled about the moon as satellites. Coon Butte "crater" just referred to is supposed to have been formed by the main mass of the Canyon Diablo fall which has already yielded about 16 tons of fragments ranging from the size of a marble up to a little more than a thousand pounds and scattered over an area of several square miles.

Another view, and the one now accepted, is that the crater was not formed by one immense meteor, but by a mass of small meteorites, and just as a charge of small shot, at short range, will smash through a board, so these little projectiles together drove into the earth and formed the crater—this theory accounts for the failure to find a vast iron meteorite and explains the thousands of fragments of various sizes—but mostly small—scattered over a wide area. The steam produced by the intense heat of this mass of meteorites entering the ground also aided in the formation of the crater by blowing out the disrupted rocks.

For many years past, work has been carried on at Coon Butte, or Meteor Crater, with the hope of discovering and mining the meteor or meteors, and much capital was literally sunk in borings for this purpose. Mr. D. M. Barringer has been in charge of the work of exploration, and his report, made in January, 1926, announced, "Eventually this hole (the last boring sunk through the south rim, it having been determined that the mass approached from the north at an angle of approximately 45°) encountered what is beyond doubt the upper part of the buried cluster of iron meteorites, finding it exactly in the predicted position.

"The work . . . was (thus) successful in locating the hidden meteor and in pointing the way for future exploration."

Mr. Barringer also explains another point: "it has been generally supposed that the search for this meteorite was for the purpose of obtaining a quarry of pure iron," but we are told that "It must not be thought there is expectation of mining solid iron . . . the iron, as iron, would be of little value. It contains, however, enough nickel to render it a valuable ore—from 5 to 6 per cent.—and a small, but valuable, amount of some of the platinoid metals."

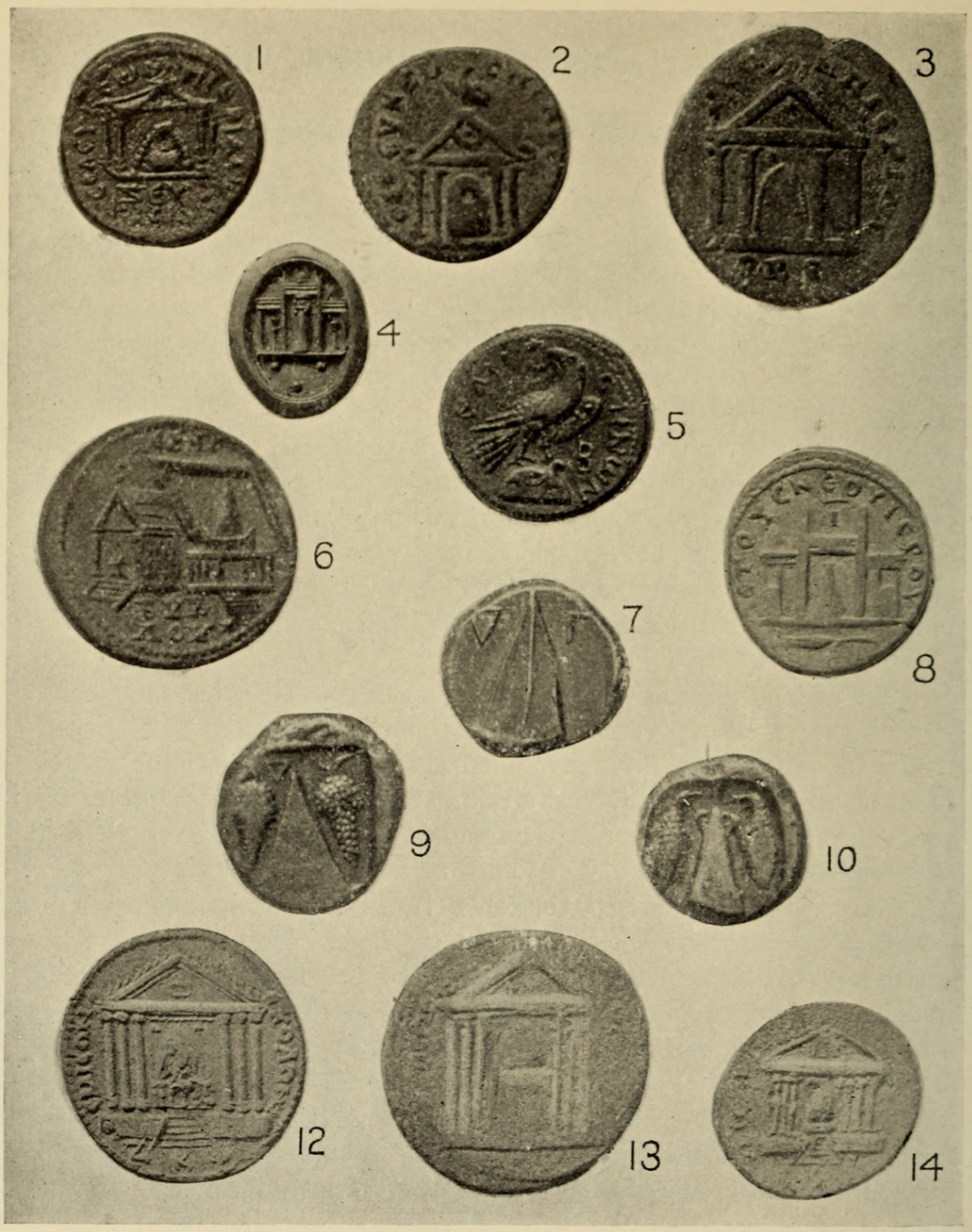
Still, what are meteorites? According to some they are fragments of a lost world, shattered by collision with another that had somehow got out of place. But it must have been a world of strange composition, for while analyses of meteorites have yielded no new *elements* yet they have been shown to contain some minerals which are combinations of elements not found upon earth. These are Maskelynite, Schreibersite, Moissanite, Troilite, Daubreelite, Oldhamite.

Yet another idea advanced by men of science was that meteorites were "condensed" out of clouds of dust, particularly from dust ejected by a volcano. This theory was applied to a fall that occurred in Siena in 1794 during an eruption of Vesuvius, but was badly weakened later by the fall of blazing meteors, accompanied by loud explosions, from a cloudless sky.

There is an evident connection between meteorites and comets, especially in regard to their orbits, or the track they pursue through space, but that there is any physical connection between them is doubtful, since comets themselves are regarded as gaseous bodies.

Meteorites seem to have no preference for any particular part of the earth's surface and they fall at any hour of day or night: the large meteors seem also to occur at any time of year, but the smaller meteors, the shooting stars, have periods of great abundance in August and November at intervals of many years. The most noteworthy of these "star showers" took place in 1833 and less notable ones occurred in 1866 and 1867: later appearances have been far less spectacular and it is believed that the influence of other planets may have diverted from its course the stream of small meteors through which the earth passed attracting to its atmosphere the bodies to which the display was due.

Naturally there are some popular beliefs in regard to meteors and some superstitions; that there are not more is probably due to the fact that so few of these visitors from space have in the past been seen to reach the earth. A pleasing belief is that a "shooting star" betokens the death of some one, usually a person of importance, and it is probable that this belief is of very ancient origin, dating back to the time when our



BÆTYL COINS

1 Seleucia in Syria c. 100 A.D.
2 " c. 200 A.D. } COPPER
3 " c. 300 A.D.

4 Amulet. Graeco-Roman GOLD

5 Emisa, 150 A.D.
6 Biblos, 200 A.D. } COPPER

7 Paphos in Cyprus, 70 A.D.
8 Mallos in Cilicia, 450 A.D.
9 " " " " "
10 " " " " " } SILVER

12 Emisa, Caracalla, Temple of Elagabal at Emisa
13 within conical stone of Elagabal } COPPER
14

By courtesy of the American Numismatic Society

lives were influenced by stars and planets. Superstitions, inherited beliefs, are long-lived and die hard; centuries have passed since, according to Scripture, "The stars in their courses fought against Sisera," and we still upon occasion "thank our lucky stars" and speak of people as saturnine or jovial as the case may be.

A very attractive theory is that which assumes that when this earth of ours was taking shape out of chaos, after aeons of time, the germs of life were brought to it by some meteorite. This has the advantage of putting the origin of life so far away in space and time that we have no facts to interefere with any theories concerning it.

Perhaps the most famous of meteorites is the Black Stone of Mecca, the stone on which one legend has it that Jacob pillowed his head when he dreamed of the ladder reaching from earth to heaven whereon the angels ascended and descended; according to another version it was presented to Abraham by the angel Gabriel, for what purpose we are not told, while iconoclasts claim it to be a very very ancient pagan fetish long ago built into the walls of the Kaaba. We have no records telling of the Black Stone of the Kaaba, but from the writings of Livy, Plutarch and other early historians we know that meteorites were recognized and revered for centuries before the Christian Era and perhaps the excavations in the Roman Forum may some day bring to light one of these sacred stones. And yet, as we have seen, curiously enough the heavenly origin of meteorites was long denied by modern scientists.

As the ancients supposed the stars to be the residences of the gods, falling stars, or meteorites, were regarded as signifying the descent of a god, or the sending of his image to the earth. Hence they were received with divine honors, held sacred, and temples were erected for their reception. One of these stones is mentioned in the Acts when the "town clerk" said, "what man is there that knoweth not how that the city of the Ephesians is a worshipper of the goddess Diana and of the image that fell down from Jupiter?"[1] Not only were meteorites held to be sacred but medals and coins were struck in their honor or to commemorate their fall, a practice that endured for some six hundred years. It is interesting to note that while originally the effigies on these Bætyl coins bore some resemblance to the object they commemorated, as time went on the representation of these heaven-sent messengers became more and more human-like. Also, judging by the number of "tokens" struck (the collection of Dr. Brezina, of the Vienna Museum, numbers several hundred), one can not help feeling that then, as now, many objects were considered as falling stars that had no claim to that designation.

[1]Acts, XIX, 35.

The custom of placing objects in temples endured into the Christian Era and—in the shape of votive offerings—is still in vogue, so it is not surprising that the first meteorite actually seen to fall, the major portion of which is still preserved, was placed in a church where it remained for many years. This historic meteorite fell at Ensisheim, Alsace, between eleven and twleve of the morning of November 16, 1492, and a piece of it was included in the Ward-Coonley collection now incorporated in that of the Field Museum.

There are various popular errors in regard to meteorites, the most common being that they are intensely hot when they strike the earth, a very natural error since we see them traversing the air in a blaze of fire. So far from this being the case, they may be very cold, the Colby, Wisconsin, meteorite for instance was covered with frost when found shortly after its fall, although this occurred on July 4th. Why they are not hot is explained by Elihu Thomson in his consideration of Meteor Flight, which also explains some of the external features of meteorites:

"Innumerable meteoric bodies enter the earth's atmosphere daily from outside space, but few of these 'shooting stars' ever reach the earth's surface, because the atmosphere forms a sheath protecting us from them. If the velocity of a body entering the air is very high as compared with that of the earth, for example, 30 or 40 miles per second, the resistance offered by the air in front of it may be great enough to break it into fragments or crush it, while the high temperature given to the air thus compressed progressively melts and vaporizes the outer surface of the mass and then of its fragments. Thus, meteorites in their atmospheric flights are virtually subjected to a highly heated blast of strongly compressed air. Magnetic (the black) oxide of iron, which is formed by this burning of the metal in oxygen or air, is more fusible than iron itself, and it is swept back from the surface of a moving meteorite as fast as it is formed, much of it in spray or drops, but some of it in the state of vapor in the trail which marks the course of the body in the air. Melted, pear-shaped drops have, in fact, been observed in and falling from the train of slowly moving iron meteorites. If the meteoritic mass survives its passage through the air, it retains a thin, shiny, black skin over its surface composed of the iron oxide, or of glass containing iron oxide, in the case of the stony meteorites.

"An important point to be understood from the foregoing is that the energy appearing as heat is not transmitted to the body of the meteorite as such, but is dissipated in the air along with the oxide layer continuously formed, ripped off and left behind in the meteorite's path. Before the mass enters our atmosphere, its temperature is that of the space around it (absolute zero, —460° F.), and its flight through the air lasts for such

a short time, that the heat generated on the outside, though very intense, does not enter its interior. For comparison, when we turn a vigorous blast of hot gas, as a blowpipe flame, on a block of ice, the ice melts rapidly, the water on its surface is blown off as fast as formed, but what remains is always ice.

"If of somewhat rounded form, the meteorite may have rotated in the air, presenting all sides in succession to the corrosive wasting by combustion. If of irregular or elongated form, rotation would be checked, the body would advance in a position resulting from a balanced resistance around its center of mass and any further turning would depend on the rapid wastage of projections by fusion and combustion. There is, however, but little time, only a few seconds, at most, for readjustments of position to resistance encountered in the air. When there is little or no rotation, hollows or pits are dug in the forward side of a meteorite by the fierce air blast.

"The Willamette meteorite is a good example of a mass escaping fracture and dissipation, and it shows in marked manner the hollows, pits and grooves on the forward side, that which is now turned away from the center of the hall."

Another common mistake is that meteors pass, or fall, near the observer, when they are really miles away. A few years ago a fine meteor passed along the New England coast and observers south of Boston asserted that it dropped into the sea at the most a few miles distant; as a matter of fact it seems to have fallen many miles to the north of Cape Ann.

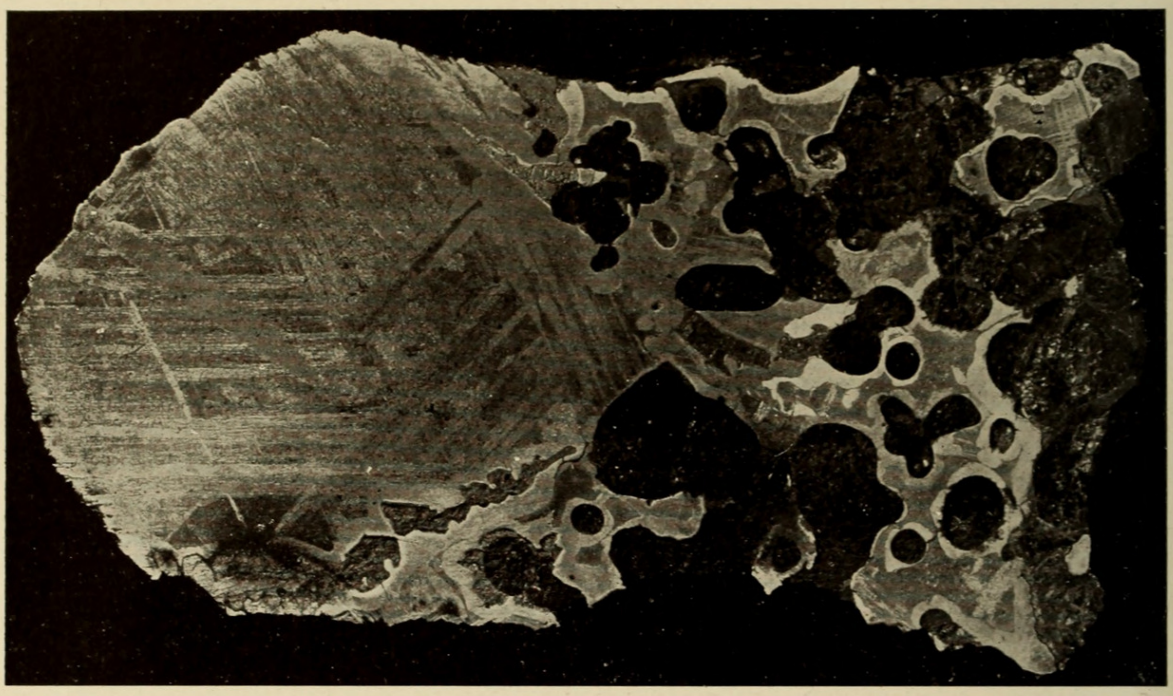
The death rate from meteorites is so low as to be negligible; while there have been a number of very narrow escapes, there is but one death actually on record, and that occurred in 1827, in India. Perhaps the narrowest of these escapes was when in 1847 a forty-pound meteorite crashed into a room in Braunau (Bohemia) in which three children were sleeping, covering them with dust and debris but leaving them unharmed.

The variety of objects sent to museums in the belief that they are meteors is astonishing, the most likely looking specimens usually proving to be pieces of furnace slag and the most unlikely including a "chunk" of cement which the sender declared had been seen to fall. Really very few meteorites have been seen to fall and later on been recovered, largely due to the point just noted that the distance of the fall is usually greatly underestimated.

Meteorites may be conveniently grouped in two classes, Siderites, or Iron Meteorites, and Aërolites, or Stony Meteorites. A third class, known as Siderolites, has been made to include forms that consist of both stone and iron but this can hardly be defined since such masses vary

from almost pure iron to almost pure stone. An important constituent of iron meteorites is nickel found in varying quantities and giving rise to the curious Widmanstätten figures shown on sections of polished and etched meteorites. This name was given in honor of Aloys Beck von Widmanstätt who first noted these figures in 1808.

While meteoric iron is soft, it is extremely tough and difficult to cut so that sawing a section from a meteorite is a slow process. In the

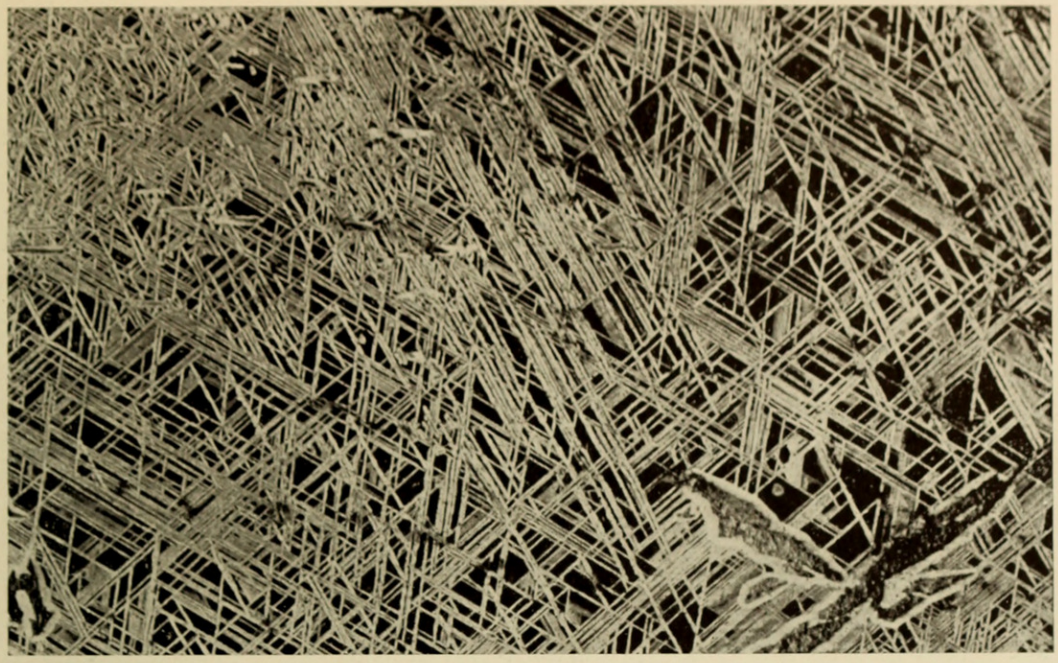


THE STRUCTURE OF METEORITES

A section of Brenham (Kansas) siderite (nickel iron) on the left, passing into siderolite (iron and stone) on the right. Note the broad Widmanstätten lines.

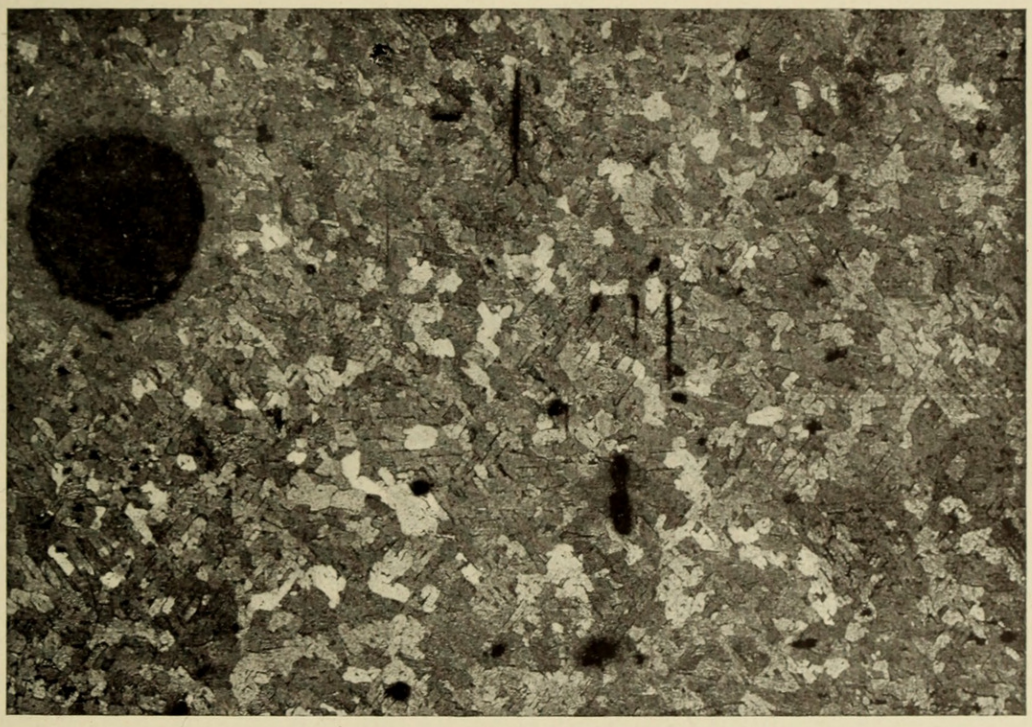
General Guide for 1914 and later, it has been stated that the occurrence of nickel in meteorites led to the adoption of a nickel-iron alloy for the armor for battleships, and as it is always difficult, and often impossible, to find any authority for an "it is said" it may be well to note that this statement came from Mr. Edwin E. Howell, who had much to do with meteorites, and who told the writer he had been informed that the extraordinary toughness of a meteorite which had been sawn at the Navy Yard, Washington, and the knowledge that it contained nickel, led to the trial and later adoption of the alloy for armor-plate.

Meteorites seem not to have attracted the attention of collectors or of museums until a comparatively recent date: there is no mention of any in the cabinet of Sir Hans Sloane, nor in the earlier guide to the



THE STRUCTURE OF METEORITES

Widmanstätten lines very clearly shown in a section of Carleton.



THE STRUCTURE OF METEORITES

A section of Willamette, showing its granular structure; the Widmanstätten lines are very faint.

British Museum (1762–1763) which was based on his collection. In 1926, the great collections had a combined representation of 820 falls. Fragments of the falls were to be found in five great museums, as follows:

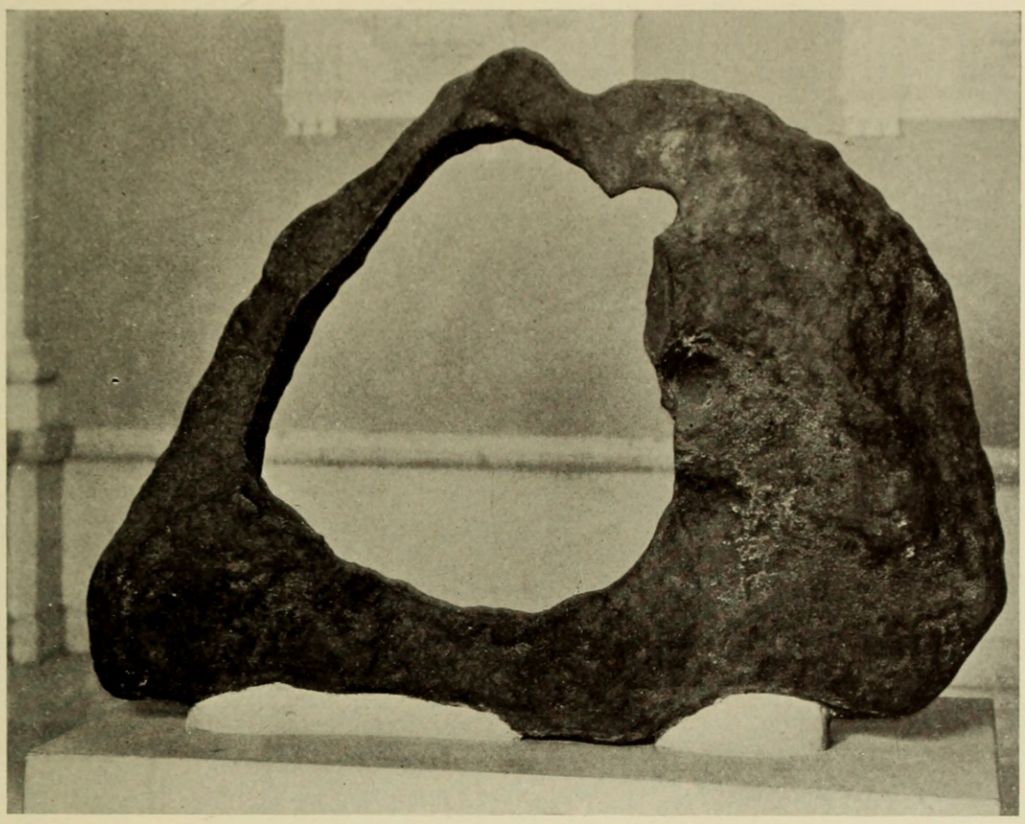
Field Museum of Natural History (1925)	670 falls
British Museum (1922)	653 falls
Vienna Museum (1904)	560 falls
American Museum of Natural History (1925)	548 falls
U. S. National Museum (1925)	521 falls

The Field Museum owes its supremacy to the acquisition of the Ward-Coonley collection, brought together by Henry A. Ward, who devoted many years of time and travel to gathering the largest private collection of meteorites ever made. In making this collection Professor Ward visited and described the Bacubirito (Mexico) Meteorite, which he considered to be even larger than Ahnighito, having an estimated weight of 50 tons; however, this has never been weighed, and meteorites, like fish, are apt to lose in weighing, even Ahnighito, estimated at first to weigh 100 tons, and then at 50, shrank nearly 14 tons, when placed on the scales, and we suspect that should Bacubirito be tried in the balance it would be found wanting a number of the 50 tons ascribed to it. It required the labor of twenty-seven men to fully expose Bacubirito and it was then found that it rested on the solid rock, having apparently fallen before the soil had formed. The measurements of this great iron are 13′ 1″ long × 6′ 4″ × 5′ 4″. Ahnighito and Bacubirito shrink into insignificance compared with the iron reported to have been found in 1921 in the desert of Adrar, near Shingeti, Mauretania. This is said to be 300 feet in length, but as yet the report has not been verified. Another of Professor Ward's acquisitions was a piece of the Vermian iron preserved at Teheran, Persia. How to cut a piece from this was something of a problem; the arsenal at Teheran was equipped with a planer, but no motor, and the deficiency was supplied by running the planer back and forth by man power for several days.

The U. S. National Museum has labored under the handicap of limited appropriations and a belief that the national institution should pay more for a given object than any other, a belief that allowed these "others" to acquire various specimens at much less than the price originally asked. It is pleasant to record that of late years there is a growing recognition that, after all, the museum is a national institution and it is becoming more and more the recipient of valuable gifts.

So much for meteorites in general. A few words about some of the more remarkable specimens in the Museum collections are now in order. The American Museum of Natural History is the fortunate possessor of

the largest meteorite so far discovered (Ahnighito), and the largest, as well as the most interesting, found in the United States (Willamette). It also has a fine representation of the Canyon Diablo, popularly famous for containing diamonds, and a portion of the Long Island, Kansas, unique for showing a movement in the mass before it fell; so its collection may well claim to stand first as regards quality. The larger, more striking meteorites are displayed in Memorial Hall, the smaller, including many

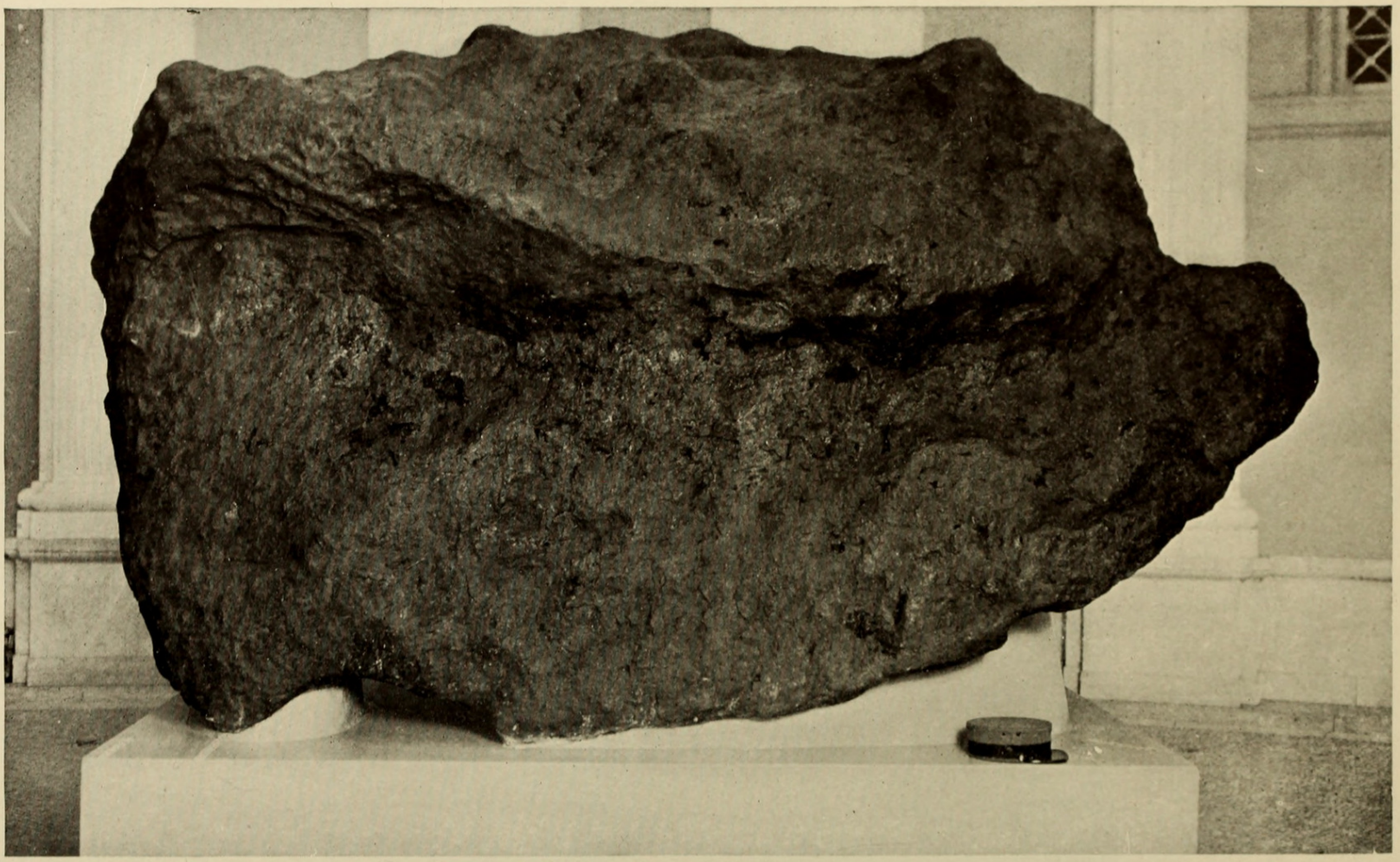


TUCSON

An iron meteorite weighing 1400 pounds in the collection of the United States National Museum.

choice examples showing structure, are at present installed in the North Corridor, near the Auditorium.

AHNIGHITO, chief among meteorites, lay for many years on an island in Melville Bay, Greenland, and was secured by Peary in 1897 after unsuccessful attempts in the previous two years: the last of these, fortunately, left the "great iron" near the water's edge, on a rocky ledge that served as a pier. How it was finally placed aboard the "Hope," how the "Hope" smashed her way through the ice out of Melville Bay, and struggled through a gale to the lee of Wolstenholm Island where the



AHNIGHITO

The largest known meteorite, weight 36½ tons, brought from Greenland by Peary in 1897. Called the Tent by the Eskimo, christened Ahnighito by Marie Ahnighito Peary. Presented, together with the Woman and Dog, by Mrs. Morris K. Jesup, 1905.

THE WOMAN

One of the Cape York irons, weight 3000 pounds. In spite of the fact that she was guarded by the dog, the Eskimo pounded off fragments from which to make knives.

meteorite was lowered to a position of greater safety, is graphically told by Peary in "Northward Over the Great Ice." How it was christened Ahnighito by Marie Ahnighito Peary, then not quite a year old, just as the meteorite started on its last journey, is also told by Mrs. Peary in "The Snow Baby." So much bad weather attended the efforts to remove the big meteorite that it is small wonder that not only the Eskimo, but even some of the sailors regarded it with superstitious awe, but the spell was finally broken and no evil has accompanied it to its present resting place.

Associated with Ahnighito, which was known to the Eskimo as the Tent, though a few miles distant, were the smaller Dog and Woman, brought away by Peary in 1896, and now shown in its company.

Collectively these were appropriately called Saviksue, the great irons; and pieces of the Woman were laboriously hammered off by the Eskimo for knives, the worn-out hammer stones accumulated about it testifying to the time and patience expended in obtaining a few bits of the precious metal.

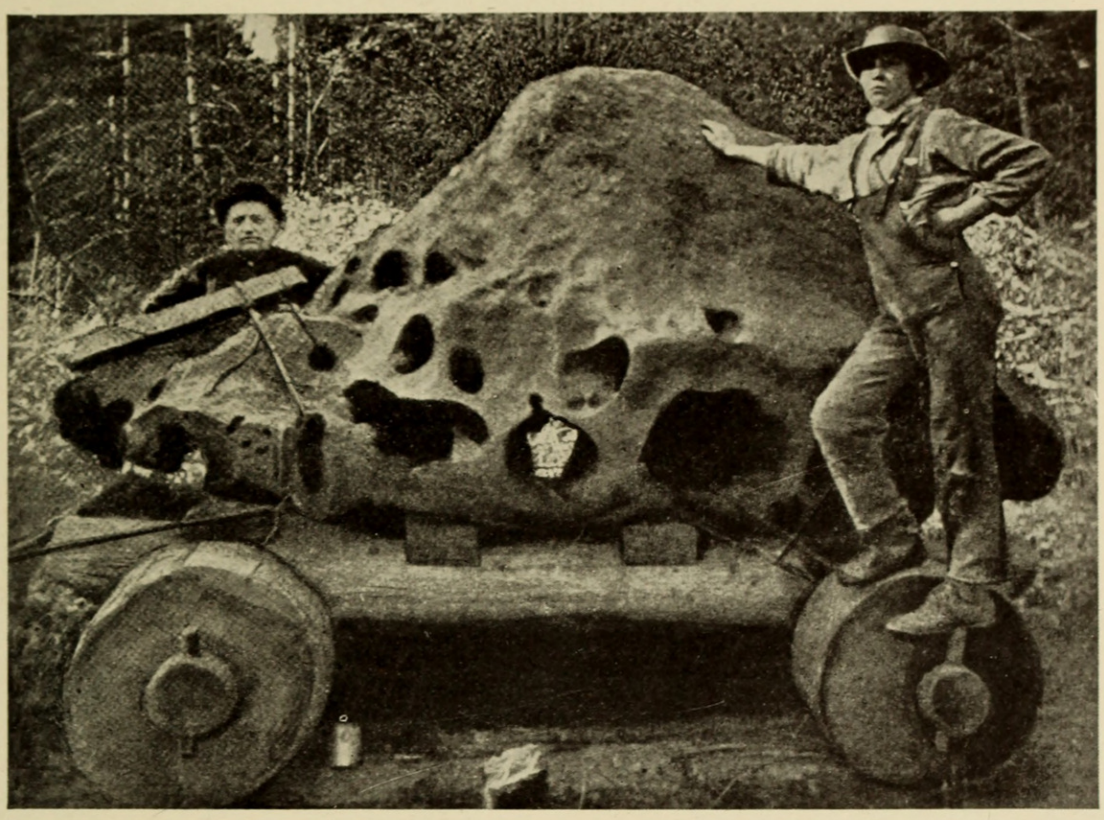
WILLAMETTE is not only the most extraordinary in appearance of any meteorite, and the largest that has been found in the United States,

THE DOG

One of the Cape York Meteorites, weight 1100 pounds. For centuries the Dog stood watch over the woman on an island in Melville Bay, Greenland.

but of interest for the struggle for its possession. It was found by two prospectors in the autumn of 1902 about 19 miles south of Portland, Oregon, on the land of the Portland Land Co. Having discovered that this was a meteorite, one of the prospectors, who lived about three quarters of a mile away, fashioned a rough but strong carriage to which with great skill and much labor he transferred the big mass of iron and with no other aid than that of his son, a horse, and a simple windlass, moved the meteorite to his own grounds. This took three months of hard work, for the ground was soft, and the meteorite heavy, the best day's work covered only fifty yards and sometimes the car was moved only fifteen feet.

When the Portland Land Company learned of their loss, and such a remarkable find could not be long unknown, they naturally entered suit for the recovery of their property and ultimately secured it, to the disappointment of Professor Ward who had hoped to make the Willamette the crowning glory of his collection. Instead, by the generosity of Mrs. William E. Dodge it now rests in the American Museum of Natural History where it arouses the interest of every visitor and where its history is daily read by many visitors. It is indeed remarkable, first for its size: it is ten feet long, and weighs fifteen and one half tons; and next

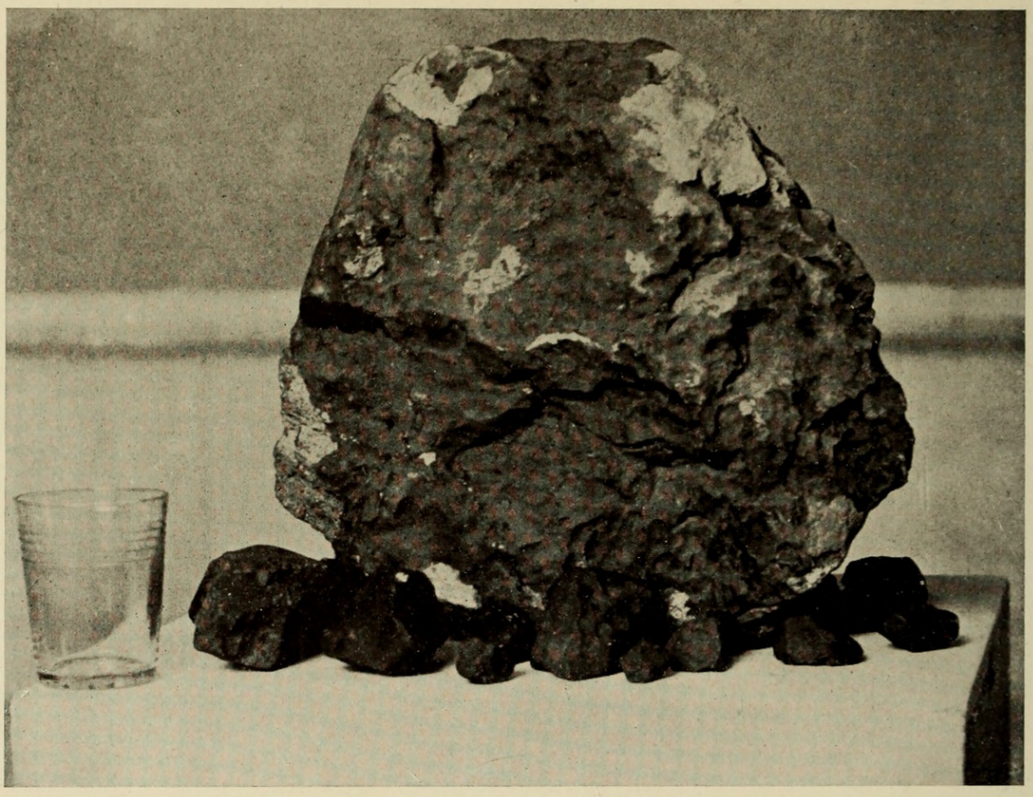


WILLAMETTE IN TRANSIT

for its appearance, being—on one side—deeply pitted with great hollows, large enough to hold a child. These are due to rusting as it lay in the ground, decomposition beginning with masses of troilite, one of the minerals peculiar to meteorites. The side next the wall is worn and slightly hollowed by the burning away of the surface as the meteor sped through the air.

Forest City is one of the few meteorites whose history is definitely known. As recorded by Dr. Hovey, "On Friday, May 2, 1890, at 5:15 P.M. a brilliant ball of fire shot across the sky from west to east in northern Iowa, its flight being accompanied by a noise likened to that of heavy

cannonading or of thunder, and by scintillations like those of fireworks. The meteoric light was dazzling even in the full daylight prevailing at the time and the noises, which were due to explosions, were heard throughout a district 200 miles in diameter. This meteor was the Forest City Meteorite. It burst when it was about 11 miles northeast of Forest City, Winnebago County, and the fragments, more than a thousand of which have been recovered, were scattered over an area about a mile wide and two miles long. Some of the pieces, each of which is a perfect little



FOREST CITY

meteorite, weigh as much as several pounds, but most of them are from a twentieth of an ounce up to twenty ounces. Forty-five fragments of this fall are in the American Museum of Natural History. The largest fragment is that shown, which weighs 75 pounds."

Holbrook (Arizona), a stony meteorite, fell as a shower of fragments, 2000 of which are in the collection of the American Museum of Natural History: they range in weight from $\frac{1}{90}$ of an ounce up of $14\frac{2}{3}$ pounds and have a collective weight of 485 pounds. The fall took place on July 12, 1912.

Canyon Diablo (Arizona) has already been noted, but it may be added that the diamonds it contains are mostly of minute or microscopic size and that it costs many, many times their value to recover them.

Long Island, found in Phillips County, Kansas, is noteworthy in several respects: in the first place it is unique in showing by its markings that some of the fragments into which it burst moved upon one another just before it fell; had it exploded when some distance above the earth these markings would have been burned away, leaving the usual crust of oxide. That it broke to pieces just before it struck is apparent because

CANYON DIABLO

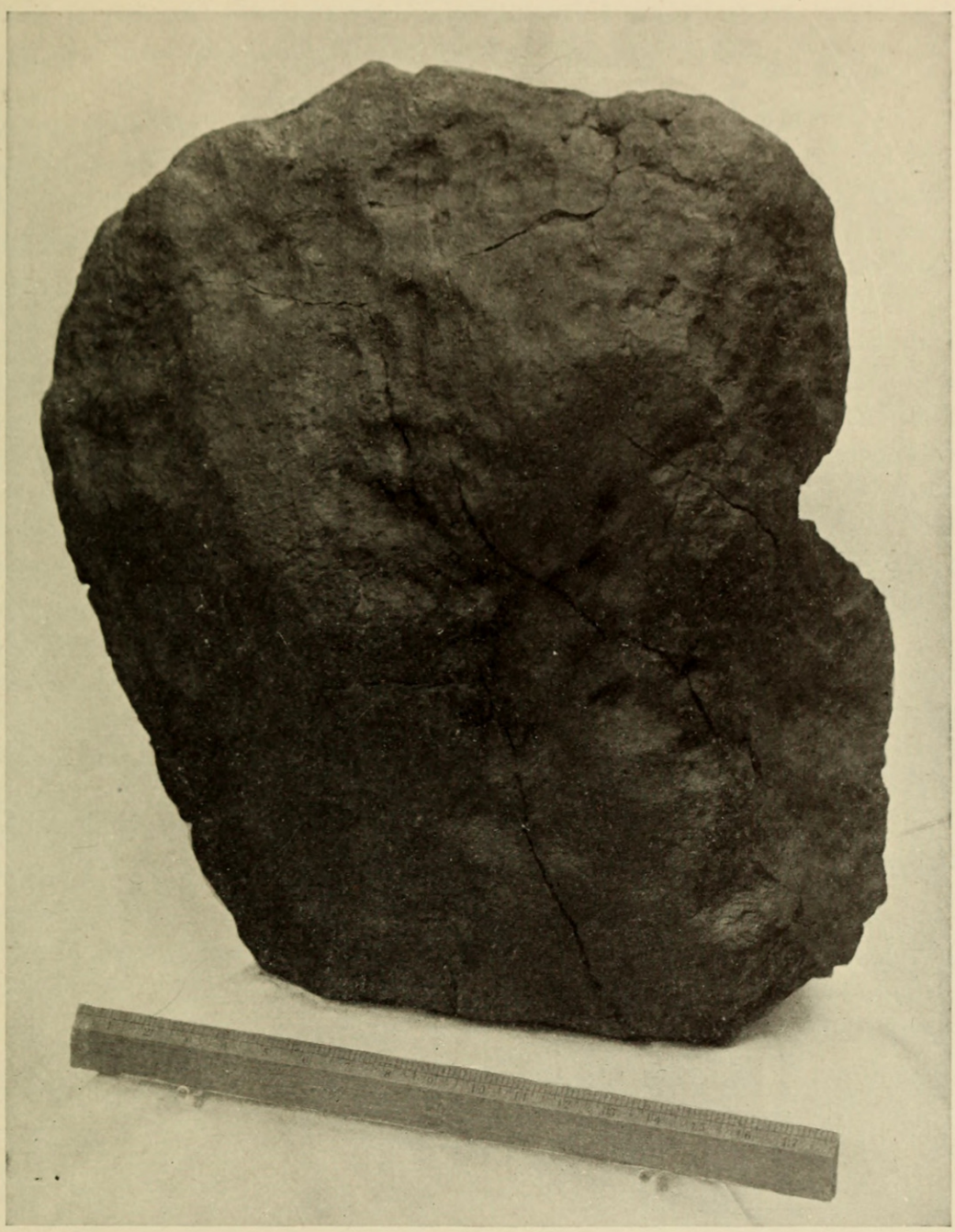
A meteorite that contained minute diamonds; only one other similar specimen is known.

the 3000 pieces that have been recovered, having a combined weight of 1244 pounds, were found in a space of fifteen by twenty feet, the most compact "shower" known. It is also unique as being, in its total weight, the largest stony meteorite so far discovered.

Selma, a stony meteorite from Alabama, is believed to have fallen on July 20, 1898, though it was not found until March, 1906, the delay in its discovery being largely due to the fact that, as usually happens, it fell much farther from the observers than it was supposed to have done. If

SECTION OF CANYON DIABLO
A diamond was found in the black spot.

LONG ISLAND
The diagonal markings show that the fragments rubbed on one another just before they struck the earth.



SELMA

Weight 306 pounds, a large stony meteorite—aërolite— in the American Museum.

Long Island is collectively the largest stony meteorite, Selma, weighing 306 pounds, is one of the heaviest single stones in the United States, the largest known being a fragment of the Paragould (Arkansas) 1929 fall, weighing 820 pounds, now in the Field Museum of Natural History, Chicago.

These are the larger meteorites or those of more popular interest, but the hundreds of smaller specimens are important for the student, though aside from the time and place of their fall it requires careful chemical analysis and the aid of the microscope to gather the information they contain.

Hoba Wes, an iron known before 1921 and observed in situ on a farm near Grootfontein, southwest Africa, is probably the largest single meteoritic mass known. According to W. J. Luyten, 1929, the exposed portions of the rudely shaped rectangular block measure $9 \times 6 \times 4$ feet; estimates as to its weight range from 36 to 70 tons. Chemical analyses show that the nickel content ranges from 5 to 17 to 35 per cent, with 18 as a probable average. Widmänstatten figures are absent on etched surfaces. In this respect it is similar to some other south African irons of the Bethany fall. Up to 1931, the iron had been only partially exposed.

And here it may be well to say that the market prices for meteorites, save for those of exceptional size, are by no means so great as their finders sometimes suppose. They have never appealed to the private collector, so there is no keen competition for their possession, as there is for eggs of the Great Auk, to "boost" prices.

Finally—any day, or night, a meteorite may fall in your back yard, though the chances are many millions against it.

The American Museum collection includes meteorites from the countries, states and islands noted in the following list

METEORITE LOCALITY LIST

Alaska
Algeria
Anatolia
Arabia
Argentina
Australia
Austria
Azerbaijan
Belgium
Bolivia
Brazil
British Columbia
Chile
Colombia
Corsica
Costa Rica
Czecho-Slovakia
Denmark
East Africa
Ellesmereland
England
Esthonia
Finland
France
French West Africa
Germany
Greece
Greenland
Guatemala
Hawaiian Islands
Holland
Honduras
Hungary
India
Ireland
Italian Somaliland
Italy
Jamaica
Japan
Java
Latvia
Mauritius
Mexico
New South Wales
New Zealand
Norway
Ontario
Persia
Poland
Portugal
Queensland
Rumania
Russia
Saskatchewan
Siberia
South Africa
Spain
Sweden
Syria
Turkestan
United States
Alabama
Arizona
Arkansas
California
Colorado
Connecticut
Georgia
Idaho
Indiana
Iowa
Kansas
Kentucky
Maine
Maryland
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
South Carolina
South Dakota
Tennessee
Texas
Virginia
West Virginia
Wisconsin
Wyoming
Victoria
West Africa
West Australia
Yugo-Slavia