The Palimpsest

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CONTENTS

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THE PURPOSE OF THIS MAGAZINE

THE PALIMPSEST, issued monthly by the State Historical Society of Iowa, is devoted to the dissemination of Iowa History. Supplementing the other publications of this Society, it aims to present the materials of Iowa History in a form that is attractive and a style that is popular in the best sense—to the end that the story of our Commonwealth may be more widely read and cherished.

BENJ. F. SHAMBAUGH
Superintendent

THE MEANING OF PALIMPSESTS

In early times palimpsests were parchments or other materials from which one or more writings had been erased to give room for later records. But the erasures were not always complete; and so it became the fascinating task of scholars not only to translate the later records but also to reconstruct the original writings by deciphering the dim fragments of letters partly erased and partly covered by subsequent texts.

The history of Iowa may be likened to a palimpsest which holds the records of successive generations. To decipher these records of the past, reconstruct them, and tell the stories which they contain is the task of those who write history.

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THE PALIMPSEST

EDITED BY JOHN ELY BRIGGS

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The Marion Meteor

On February 25, 1847, Governor Ansel Briggs approved an act of the First General Assembly creating the State University of Iowa. That was a very significant occasion. The pioneer law makers realized no doubt that they were laying the foundation for an institution that was destined to exert an important influence upon the cultural history of the State. Very few citizens knew that anything unusual had happened. The act was not acclaimed as a great achievement in the progress of education.

Even in Iowa City the people were probably more concerned with the sound of loud explosions that were heard in the middle of the afternoon. The noise seemed to come from the north. C. W. Irish said that the explosions caused great alarm. Men asked each other what the cause could be. It was a strange experience. If they had known that a meteor had fallen over near the Cedar River in Linn County, the more superstitious

might have wondered what such a celestial visitation portended. The establishment of the university and the arrival of the first great meteor in Iowa on the same day may be mentioned as an interesting coincidence.

Though people at a distance could only guess what caused the explosive sounds that winter day in 1847, there were a few men who were fortunate enough to see the meteor. One who was cutting wood, startled by the noise, noticed smoke in the direction of Marion and thought the town had been blown up. Several others actually saw fragments of the meteor hit the snow nearby.

News of the strange event soon spread. Newspapers published items about it. The fragments that had been picked up were described. Scientists heard of the meteor and collected all the information they could get. Fortunately, Charles Upham Shepard of Amherst College, one of the most active students of such phenomena at that time, investigated the Iowa meteor of 1847. He wrote four articles about it in the *American Journal of Science*. His prompt work preserved essential facts that would otherwise have been lost.

Hearing of the meteor in Iowa, Shepard at once wrote for particulars to his old friend, the Reverend Reuben Gaylord, who was the minister of the Congregational Church at Hartford in Des

Moines County. During the summer, Gaylord visited Linn County and conducted what seems to have been a very thorough investigation of the various phenomena concerning the meteor. He interviewed eye-witnesses, made notes of his own personal observations, and, returning to his home, wrote a complete report.

It is fortunate indeed that, in almost every period of Iowa history, thoughtful people, often at great effort and inconvenience to themselves, have taken the trouble to record such valuable information, thus making it available to posterity. Were this not so, scientific events of importance would soon become only matters of tradition; for, even now, it would probably be impossible to find and interview a single person who actually witnessed the fall of this great Iowa meteorite. The souls of most of those then living have long since passed on to the abode from whence meteors seem to come, and yet they can make no use of such "messengers from heaven" as means of direct communication with those still remaining on the earth.

One of the essential facts concerning meteors, in which people are greatly interested, is the exact location of the "fall", if but a single stone came down, or of the "meteoric field", if a "shower" occurred. In the present instance the "meteoric field" lay in the rough timber country along the

Cedar River, from three to four miles south of the present station of Bertram on the Chicago and North Western Railroad. This spot is seven or eight miles southeast of Cedar Rapids. At the time the meteor fell, however, the literature upon the subject reported it as being "approximately nine miles due south of Marion", the county seat.

As usual in such events, there was considerable discrepancy in reports regarding the exact hour of the fall. This could be explained by the excitement of the moment, for few observers thought to look immediately at their clocks or watches. Moreover, time pieces varied. It was impossible for people in those days to regulate their watches by radio or telegraph. The range in time given in the various reports on the Marion meteor was remarkably small. Most of the times mentioned were within a period of fifteen minutes. One of the most careful and reliable observers said that the meteor "fell at about ten minutes before 3 o'clock," which for all practical purposes is sufficiently correct.

At this time the atmosphere was almost clear. A slight haze did not obstruct perfect vision. The bright winter sun had so warmed the air that the snow on the ground was somewhat softened, and the temperature was close to the freezing point. According to Gaylord, quoting from his letter,

"the attention of the people in that region was arrested by a rumbling noise as of distant thunder; then three reports were heard one after another in quick succession, like the blasting of rocks or the firing of a heavy cannon half a mile distant. These were succeeded by several fainter reports, like the firing of small arms in platoons. Then there was a whizzing sound heard in different directions, as of bullets passing through the air."

According to persons at "a distance of ten miles in each direction the sound was like the rolling of a heavy wagon passing swiftly over frozen ground. Smoke was seen in the direction from which the sound seemed to proceed. The smoke appeared in two places, apparently about six or eight feet apart, above the elevation of light clouds, and having a circular motion. The motion of the meteoric body was supposed from the reports which were heard, to be towards the southeast, or rather south of east."

Another description of the aerial display was published nearly twenty years later, in an article prepared by C. W. Irish, a civil engineer, who lived at Iowa City. In his study of Iowa meteors, he interviewed as many eye-witnesses as possible. His information about the Marion meteor was obtained chiefly from Judge James Cavanagh who, with two of his sons, was at the time cutting wood

on the Cedar River, about nine or ten miles southeast of the place where the meteor struck.

In relating his experience Cavanagh said that, "suddenly there came from the sky above and to the west of them, a rushing humming sound, mingled with a whistling as if thousands of bullets were flying through the air. The humming sound was very loud and impressive and rapidly increased to a roar, which seemed to shake the very earth, and all these sounds ceased suddenly in a series of tremendous explosions, which appeared to be northwest of where he stood, and as he thought might be Marion, the county seat, all blown to pieces."

In the opinion of the Judge there were from four to seven distinct sharp explosions. "After the explosions he noticed a rattling rushing sound coming from the southwest, which continued for several seconds, when all the sounds ceased and he saw what he had not before noticed — a bunch of very black clouds close down to the horizon to the northwest of where he stood, and there were no other clouds in sight. Judge Cavanagh said that although he was not at all inclined to be superstitious, yet the affair made such an impression upon him that he and his sons quit their work and went home, where they found the household in great consternation and trouble at what had occurred."

Many other people had observed the meteor. "The neighborhood was in a turmoil about it, and some of the men set out to discover what had happened, and on returning a day or two after, related that a stone had fallen on the high bluffs north of the Cedar river, in township 83 north, in range 6 west of the 5th principal meridian, at the time of the occurrence of the great explosions and other sounds described, and to this stone was given all the credit for producing them."

According to Irish the explosions were "distinctly heard at Iowa City, twenty-two miles south from the place of the fall, and great was the alarm caused by them." He had no doubt that the meteoric body travelled through the air in the direction from south to north and passed directly over Iowa City. He no longer remembered in 1886 how much the meteorite weighed, but thought it was between eighty and one hundred pounds. So far as he knew only one stone was found, but he believed that a great many more fell in the vicinity, "which at the time was a wild district, having no inhabitants, and thus the chances for finding the stones which fell were small."

If Irish had consulted the available literature on the subject in the library of the State University, he might have learned that a number of fragments were ultimately discovered. The fact that his

work was evidently independent, makes his report more valuable. He was not influenced by the findings of Gaylord, and consequently his review was a new contribution to the subject.

In spite of the fact that the country was new and only partially settled at the time, there were actually several eye-witnesses who saw fragments of the meteor hit the ground. "Two men were standing together where they were at work; they followed with their eye the direction of one of these sounds, and they saw about seventy rods from them the snow fly. They went to the spot. A stone had fallen upon the snow, and bounded twice, the first time as was supposed about eight feet, the second time about two feet. The stone weighed two pounds ten ounces. The same persons heard another stone strike as it fell, supposed to be small, but they could not find it."

In the following spring, another stone was picked up "about one mile and a quarter west from the place where this fell. It was in two pieces lying together, weighing forty-six pounds. Another fragment, a portion of the same rock, was found about half a mile from the former," which Gaylord estimated from descriptions must have weighed about fifty pounds. "These were coated with a thin black covering."

Daniel C. Rogers, a farmer residing on section

21, Putnam Township, about nine miles due south of Marion, heard "a loud explosion in the air and immediately ran to his door. He heard the stone and several others whiz through the air and strike the ground, and saw the snow and dirt fly where this stone struck. The weight of the stone before it was broken up was 42 pounds." This may have been the stone that Gaylord had estimated to weigh fifty pounds. Joshua Barney, the United States land agent at Dubuque, in making the above report, wrote that, "one of the surveyors who was engaged on the survey of the public lands 40 miles distant from Mr. Rogers' house," heard the explosion distinctly.

A more exact description of the larger portion of the meteor, which was found on section 20, about a mile or a mile and a half west of the place where the Rogers stone was picked up, was published by Shepard in the *American Journal of Science* in 1848. This really proved to be two separate masses and not, as at first supposed, fragments of a single broken stone. The larger of the two stones (whose weight was estimated at about forty pounds) "was cracked through the centre, by its fall upon the frozen ground. One of these halves (weighing 21 lbs. 7 oz.) is in my possession."

This meteorite was "an irregularly shaped, four-

sided pyramid," the summit of which was an edge four or five inches long. The base of the pyramid was formed by the fractured surface which was nearly a plane, having a texture resembling fine-grained granite. "The natural outside of the stone", reported Shepard, "presents the customary depressions, though they are less distinct than we sometimes observe in these productions." The crust was unusually thick and "its adhesion to the unaltered stone strong, while its line of junction" was perfectly defined. "When narrowly observed, it is discovered that the surface of this crust is divided off, by cracks, into polygonal areas, of from ¼ to ½ inch in diameter, a consequence no doubt of sudden cooling."

A smaller stone, wrote Shepard, was "represented by the finder of it, as pyramidical in its shape; and to have measured not far from 10 inches in length, by 8 at its base, and 4 at the smaller extremity. It was completely coated by a black crust, like the other two stones. This stone (as well as one-half of the larger mass) has been broken up, and for the most part entirely lost. The few fragments of it in my possession, sufficiently evince that it differs in no sensible manner from the other two".

Three years after his first investigation, Gaylord obtained another Marion meteorite which

weighed twenty pounds and sent it to his friend Shepard. "It was found (in the summer of 1847) in Hooshier grove by Abner Cox", he wrote on July 3, 1850. "He was in company with John Hollis, of whom I obtained two fragments three years ago. They have had the stone two years or more, and by lying in the loft of a smoke cabin it is somewhat dingy in appearance. This John Hollis is the man who ground up so much of the stones that were seen to fall, in order to get silver. He was the means, however, of the careful preservation of the present mass.

"The three pieces into which it broke in striking the ground fit together exactly, so as to reproduce the original stone, with a complete coating over the whole, except on one side where several small fragments were broken out by the fall. These were gathered up and carefully preserved by the finder."

In commenting upon the appearance of this Marion meteorite, Professord Shepard declared that the "stone is perhaps the most remarkable one thus far described, for its highly regular prismatic figure, which at once suggests the idea of a portion of a basaltic column. Nor can the geologist look upon it without feeling almost certain, that it once formed part of some extensive formation in the world from whence it came."

Two surfaces of the stone, which were nearly flat, presented "a peculiar wavy, undulating surface and a deeper black color than belong to the other faces of the stone, a difference which appears to originate in the nature of the horizontal cleavage of the mass as contrasted with that which is vertical or oblique." The greatest diameter of the base was ten and a quarter inches.

The texture and composition of the meteoric material, while not entirely homogeneous, was sufficiently uniform, in appearance at least, as to involve no serious question concerning its correct identity or the true relationship existing between the several pieces. Inside the thin dark brown coating or crust, said to be of the "thickness of a bonnet-pasteboard," formed by fusion from the heat of friction while passing swiftly through the earth's atmosphere, the color of the stone was a uniform pearl gray. Closer inspection revealed many small specks of iron rust scattered through the mass, and numerous, "highly brilliant globules of nickeliferous iron". Also present were some small grains of magnetic pyrites, though far less abundant than the metallic grains.

The lumps of nickeliferous iron attracted attention. "Some were taken out as large nearly as a grain of corn", according to Gaylord. "A man from whom I obtained a fragment insisted that

they were silver. He had ground up a considerable portion of the rock to obtain this silver, and he thought he had saved enough to make fifty cents".
Professor N. R. Leonard of Iowa City, writing in the *Iowa Historical Record,* stated that most of the largest specimen was "broken up and reduced to a powder by the finder on the supposition that it contained some valuable mineral."

In scientific parlance the stones were described as being "veined white chondrite". The term chondrite signifies that the meteoric material is characterized by the presence of rounded mineral granules called chondrules. The most remarkable feature of the Iowa stone, however, was the homogeneousness of its earthy mineral which "existed in an almost perfectly insulated state". While this substance was common in meteoric stones, it had previously escaped separate recognition. To it Shepard gave the name "*howardite*", in honor of "an individual whose early scientific labors in this branch of meteorology" ranked him among the foremost scholars.

Despite the several reports upon the subject, it is difficult to state with positive certainty, either the exact number of specimens recovered from the Marion shower, or their precise individual or combined weight when picked up. This is due, in part, to a strange vagueness in the writings of the sev-

eral authorities, which might be expected when second or even third hand information is employed as the basis of scientific reports. It may also be explained by the confusing duplication of some of the records which, in this instance, seemed quite unavoidable. Moreover, several of the pieces were either partially or wholly broken up and destroyed by the finders, and therefore were not preserved in any of the permanent collections of the world. Other pieces were sawed and widely distributed in such a manner that it is hard to determine beyond doubt what individual stones these various slices came from. All this adds to the confusion of the problem, making its solution difficult if not altogether impossible.

A careful examination of the literature on this subject does not reveal whether the exact number of sizable pieces recovered was four or five. Perhaps there were even more. Their total weight was apparently not less than forty-six pounds, and probably not more than seventy-five pounds. For his trouble Professor Shepard seems to have secured the largest masses now known to exist. One weighed 21 pounds and 7 ounces and the other 20 pounds. They now repose in the cabinets of Amherst College. Another large mass, weighing 432 grams, is at Tubingen. The catalogues of the Field Museum list two pieces: one, number

255, weighing 128 grams, a complete specimen with crust, and intersected with numerous fine cracks; and a second, number 1749, weighing 60 grams, a mass with crust and polished surfaces. Other fragments and sections are distributed throughout the important collections of the world, but their exact whereabouts is uncertain. It likewise is not beyond the range of probability that pieces yet remain upon the meteoric field along the banks of the Cedar River in Linn County.

After ninety years, however, such fragments would probably be so weathered through long exposure that only an expert could discern their true identity. Nevertheless, people are continually picking up meteorites which probably came to earth before the dawn of history. Who knows what a thorough search of the several meteoric fields of Iowa might yield? Some Boy Scout would win the approbation of astronomers and scientists if he were able to find and salvage one or more fragments of the Marion meteor.

BEN HUR WILSON

The Leonid Shower of 1867

"Stars fell on Alabama," more than one hundred years ago, on November 13, 1833, in such vast numbers that the "sky was as full of them as it ever is of snowflakes in a storm," declared an old lady who described the phenomena. The heavens "looked like a giant umbrella." The tip of this umbrella seemed to rest in the constellation "Leo", from which point a majority of the "falling stars" appeared to radiate. Hence the name, "Leonids". Stars fell on Iowa also in 1833, but only the earliest of the white settlers were present to witness the event.

Realizing that as many as 200,000 meteors per hour, over a period of five or six hours from midnight till dawn, were visible from a single vantage point, it is not hard to believe that the sight struck terror into the hearts of ignorant colored slaves of the southern States, and that many of their more sophisticated white masters were only slightly less alarmed. It is not surprising that the story of the "falling stars", like that of the flood, has been handed down from generation to generation.

This "star shower" was not entirely unexpected, for a similar one had been noted in No-

vember, 1799, and others previously at regular intervals of thirty-three or thirty-four years. From these observations and astronomical calculations, the Leonids were attributed to a swarm of meteoric material flowing through space along the path of an old, partially disintegrated comet, known as Tempel's comet, to which they apparently bore definite relation. It was therefore confidently predicted that a recurrence of the Leonids would take place during November, 1866 or 1867, at which time the earth, revolving in its orbit, was scheduled to pass through the region in space infested with these remnants of "Tempel's" head.

As the date approached, students and teachers in the colleges and universities manifested unusual interest in astronomical matters. At Iowa City a course in astronomy was being offered at the State University, under the tutelage of Professor Nathan R. Leonard. Of the earlier workers in Iowa meteoric research, Leonard undoubtedly ranks first. He was skilled in mathematics, scientific in his attitude toward learning, and tremendously interested in current affairs. It is not surprising that he should contribute to astronomical history by his meticulous investigation of the Leonids of 1867. Leonard and the Leonids — what's in a name?

American observers were alert in 1866, but the

Leonid shower that year was disappointing. In Europe, however, the meteoric display on November 13th was remarkable. A year later to the day, America witnessed a shower which, while not comparable to the magnificent one of 1833, was of sufficient importance to make it memorable. In a long detailed report addressed to H. H. Brainerd, the editor of the Iowa City *Republican,* on November 20, 1867, Professor Leonard described the phenomenon and his methods of observation. Most of this letter, as published in the *Republican* for the benefit of "our citizens who were so unfortunate as not to be witnesses of the great Meteoric shower of the night of November 13-14," is here reproduced.

Some weeks since [wrote Professor Leonard], in the anticipation of such an event, a company of thirty or forty students was formed — mostly composed of members of the Franklin Scientific Association — and from the Sophomore and Junior Classes of the University — having for their object the noting of the *Number, Direction, Period of Visibility* and *Lengths of Arc* that might be described by the most brilliant meteors — together with other such items as they might have time or opportunity to notice.

After spending a few evenings in tracing out the constellations — the look out was commenced

on Saturday, Nov. 9, with a view, first to *practice,* and second, to ascertain whether there was any gradual increase in the number of falling stars — extending over a period of several days previous to the shower. As a result we have not found, save on the mornings of Saturday and Tuesday, any more than on any ordinary night in the presence of the full moon.

From the commencement of their watching, until the evening of the 13th, only four observers were out at a time — or one for each point of the compass. On that evening they all assembled at my recitation room — and were divided into three sections, consisting of 12 each, and assigned respectively to watches, from 10–12, 12–2, and 2–4.

The position chosen was the octagonal room, in the second story of the cupola of the University Hall [Old Capitol], where you may notice that there is a window at the middle of each side, with an exterior column on either side of it, so that when the blinds and sash were removed, an observer, placed within, could view just one eighth of the sky.

At a few minutes before 10, the first section took their places — one at each window, two in a reclining position on the projection outside, to keep watch near the zenith — one within at a

desk, with lantern and paper previously ruled in columns for the purpose, to keep a record of the observations; and the twelfth to act as occasion might require. The columns were headed thus:

Quarter of Compass.	Direction of Motion.	Confor-mity.	Time Visible.	Arc of Motion.	Remarks

Everything being in readiness, the work began at 10 o'clock. A short time before 12 o'clock the second section were called up so as to take their places promptly at the expiration of the hour.

At 20 minutes before 1 o'clock, it was found that one person could not record fast enough, and the unemployed men undertook the record for one half of the circuit.

Second section relieved punctually at 2 o'clock. At quarter past two, both recorders were unable to keep a full record, and from this time forward each observer counted to himself the number appearing in his quarter, and only called out the most remarkable for record. At this point, in accordance with previous arrangement, the University bell was rung to awaken students and citizens — soon the Church bells joined in, and even the bell down on Mechanics' Academy contributed to the general effort to call everybody up to witness the exhibition. Sometime before 3 o'clock, a second observer took his place at the S. E. and soon after a second upon the east.

The following table shows the result of the count for each hour. The meteors were classified according to their conformity and non-conformity to a direction proceeding from the constellation of Leo.

Hours	Conformity	Unconformity	Total	Remarks
10–11	2	5	7	Prospect poor, a little hazy, with light clouds.
11–12	2	6	12	Squad inclined to doubt whether there would be a shower. Clear.
12–1	35	16	51	Better — Quite clear.
1–2	102	17	119	Better still — Quite clear.
2–4	nearly all		5000	Actually counted 4748. Not counted on W. Quarter.

Note here the great increase in the proportion of conformable meteors. Out of 1638 seen by three observers, viz. Messrs. Wilson, Glass and Greene, only 22 were thought to be unconformable — that is, not coming from the point of the radiant.

In regard to the color, it is my impression that

of the hundreds that left trains behind them — the greater number seemed to be of a green color — very many yellow at the middle and gradually changing to green at the margin — a color a little darker than the flame of the metal barium, and not far from the hue of copperas. On comparing this statement with the views of several observers, I find all agreeing thereto.

The time of maximum activity was from 3 o'clock, 15 min. to 3:40. Messrs. Glass and W. D. Wilson on the S. E. quarter counted by hundreds, keeping the time of each hundred, commencing at 3 o'clock by their watch, which was 7½ minutes fast. The following is the result: 1st 100 counted in 7 minutes; 2d in 5, 3d in 6, 4th in 3, 5th in 3, 6th in 3, 7th in 2, 8th in 2, 9th in 2½, 10th in 4, and 11th in 10 minutes. Closing at 3:55 by their time, or at 3:47½ true time. It will be seen by adding the times of the various 100's that they lost 7½ minutes during their counting. Most of this occurred at 3:31 by their time, after the counting of the 8th 100, when, in consequence of the great number that appeared, they were unable to keep a reliable count. From this, it would seem that the true period of maximum was about at 3½ o'clock, and not only that, but that the decrease was far more rapid after the maximum than the increase had been before.

During the hour from 3 to 4, and also after 4, parties of 9 each were formed on the college campus, for the purpose of counting those that issued from Leo, and they found on an average about 40 per minute during the time from 3:15 to 3:40.

There was a very fine opportunity to determine the position of the *Radiant,* or position from which they seemed to proceed. According to observations made at a quarter past three o'clock, this radiant was a very well defined *point,* close to the star 97, in the sickle of the constellation *Leo.* At about half past 3, the radiant seemed to be a short line or at most a very narrow ellipse, having this star for its center, and extending a short distance in either way in the direction of the star Zeta.

This it will be seen agrees with that observed by Prof. Watson, of Michigan University; but disagrees, by about 5 degrees, with that obtained at Washington, D. C. It may be possible that this difference is due to a difference of latitude in the stations. At all events, it cannot be doubted that our result is the *true one for this place.*

There were several particular observations taken. The first to be mentioned is, that in some instances a separation took place between the meteor and its train, before the former disappeared.

At 9 minutes to 3, a meteor started from the

radiant and proceeded directly over the star Dubhe (the northernmost of the two pointers), followed by a broad train about 5 degrees long. The separation of the meteor and train took place just as the former crossed the star named. The train remained visible for the space of 4 minutes, drifting meanwhile to the S. E., shortening up as it went, without, however, growing much, if any, narrower, and disappeared after retreating about 7 degrees. The last glimpses that I had of it, gave me the idea of a spiral form, but I could not be very positive about it.

At 4 minutes to 3, another meteor left the radiant and proceeded to the star *Zeta Draconis,* leaving there a train, behaving just as the last described, retreating 2 degrees in 3 minutes. At 3 minutes after 3, another passed over *Mizar* (the middle star in the handle of the Dipper), leaving there a train that retreated 1½ degrees in 2 minutes.

At 8 minutes after 3, a very large meteor passed over to the head of Orion, leaving there a train 11 degrees long, and almost immediately afterward was seen to separate into several parts and disappear. The train floated a little to the east of south, a distance of 11 degrees, the middle moving more rapidly than the extremities, so that it took up the form of a crescent, with the horns pointing

N. W. It should be noted that this train appeared near to the full moon, so that its period of visibility was thereby much shortened. From this train, before the separation, one observer thought he saw three small black streaks descending for a short distance, and curved backward toward the bottom.

At 1 minute after 4, another meteor passed over to Sirius, leaving, midway from Leo, a train that exhibited the same movements as the last, giving the crescent shape before disappearance.

A change of course in the path of a meteor, was carefully noted in one instance. A little after 3½ o'clock, a deep red meteor was seen passing very rapidly through Leo Minor, toward the N. W. describing an arc of 15 degrees in ¼ of a second. About midway of its course, it turned abruptly toward the west, at an angle of 15 or 20 degrees, with its previous direction.

Several bright meteors were seen to *flash out,* remain stationary, or nearly so, for an instant and then disappear. As a rule, it may be stated that the nearer these were to the radiant point, the less was their motion.

The length that this communication has already attained forbids a further description of our observations. One or two remarks must suffice for the present, and first: We may regard the posi-

tion of the *radiant* as fixed — which gives the inclination of the meteoric stream to the orbit of the earth, 22 degrees. Second — The breadth of the stream crossed from 2 hours 15 minutes, to 4 hours 15 minutes, not far from 40,000 miles, or that of the denser part crossed from 3:15 to 3:40, about 7000 miles.

Third — In consequence of the presence of the full moon, and the impossibility of counting all that appeared, the number obtained (about 5300) does not represent more than one twentieth of those that would have been visible had the night been perfectly clear and the moon absent.

The height and velocity of some of the brightest, we hope may be ascertained as soon as we can compare our record with those made elsewhere.

In conclusion, it is but just to mention the faithfulness with which the young gentlemen fulfilled the duties assigned them — keeping calm amid the general excitement, and each one denying himself a comprehensive view of the whole phenomena, devoted his attention to his own specific work. They have their reward in the consciousness of having done what they could for the advancement of science, and the gratification of having secured, so far as we know at present, the fullest series of observations that have been made of this meteoric shower. To any one who witnessed the scene, I

need not say that it was a *grand* one. When hundreds of these celestial visitants, with their brilliant streamers, were every moment flashing across the sky, that soul must be calm indeed that could contemplate the spectacle without emotion. Surely, no one that saw it will ever forget the morning of November 14, 1867.

BEN HUR WILSON

Comment by the Editor

MESSENGERS FROM SPACE

Everybody is a back-seat driver on this mundane sphere and, regardless of any amount of admonition, the unseen chauffeur follows the course prescribed by the immutable law of gravitation. The speed is terrific, but the planets take the curves in perfect equilibrium. The solar system is so nicely balanced and the orbits of the planets are so true that these celestial travelers implicitly obey the traffic rules of the heavens.

Nevertheless, the passage of the earth through space is beset with danger. Many irresponsible vagabonds weave in and out among the stars like drunken drivers. These dangerous rovers are the comets. More than a million of them infest our solar system. These denizens of space are enormous collections of gas and stony fragments. The head of a comet may be a million miles in diameter and the tail a hundred million miles long. Some comets travel in such large orbits that they come into view only once in a thousand years, while others return at rather frequent intervals. No one knows what would happen if the earth should col-

lide with a comet: probably nothing more serious than a brilliant shower of meteors.

Meteors may, indeed, be listed among the perils of the earth. Mysterious in origin, these derelicts of the heavens, commonly called "shooting stars", are extremely numerous. The universe is so full of such cosmic rubbish that the earth is constantly being pelted with cruising chunks of iron and stone. Millions of them fall into the atmosphere every day and are set gloriously ablaze by the friction of their swift journey through the air. But they usually cause no serious damage because most meteors, being no larger than pebbles, are burned up before they hit the ground.

Occasionally, however, huge meteorites have plowed into the earth's surface leaving great scars like the Canyon Diablo crater in Arizona. The largest meteoric fall of historic times occurred in northern Siberia in 1914. When the place was visited thirteen years later, more than two hundred craters were found, some over seventy-five feet across. For fifteen miles in every direction the ground was seared as if by a gigantic blow torch. And for twenty miles beyond the charred area trees had been uprooted by the violence of the explosion. What if that forty thousand ton meteorite had struck a city! And who knows but that the earth may sometime collide with a meteor-

ite so large that a new velocity and direction may be imparted to our planet's axial spinning and thus greatly change the present order.

Most of the meteoric material in space seems to bear no definite relation to the members of the solar system. Each particle or family of particles appears to be utterly independent of the others, speeding helter-skelter, insect-like in different directions. Sometimes, however, the earth passes through a swarm of meteors. These are probably the remnants of an old comet, for some of the meteoric swarms follow the orbits of comets that have disappeared. When the earth crosses the old path of Tempel's comet every thirty-three or thirty-four years, the whole sky is filled with shooting stars.

If the night of November 13th is clear and the moon is dark, as in 1833, the Leonid shower is positively terrifying. Even in 1867 when the moon was full this display of celestial pyrotechnics was a magnificent sight. Unfortunately the two Leonid showers since then were disappointing.

As a place for the observation of meteors, Iowa has been unusually favored. In less than half a century, four of the largest meteorites of North America, whose coming has been witnessed and recorded, fell within the borders of this State. Though only a few people saw the Marion meteor

in February, 1847, it attracted considerable scientific attention. On the evening of February 12, 1875, came the great Amana meteor, which for sheer brilliance has seldom been surpassed. The Estherville meteoric shower of May 10, 1879, was the largest of the iron-stone type that has been witnessed anywhere: the principal mass, which weighed four hundred and thirty-one pounds, penetrated the earth farther than any other in the world. Late in the afternoon of May 2, 1890, thousands of people within a radius of more than a hundred miles of Forest City saw a great fire-ball come roaring out of the western sky. For a moment it eclipsed the brightness of the sun.

Though the origin of meteors is mysterious, their substance is not strange. In all the enormous quantity of meteoric material recovered, no new element has been discovered. Stony matter, iron, and nickel are the usual materials of which meteors are made. If they come from other worlds, they tell few secrets. Is the whole universe composed of earthly stuff? Has life ever existed elsewhere? What a marvel it would be if a meteor should some day bear a fossil to the earth! These messengers from space carry more questions than answers.

J. E. B.

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