The PALIMPSEST

VISITORS FROM OUTER SPACE
Artist's Concept of Falling Meteor

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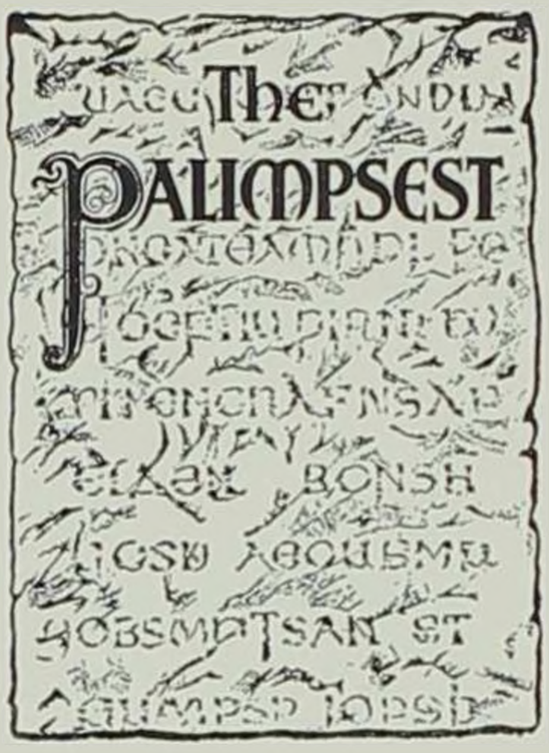

The Meaning of Palimpsest

In early times a palimpsest was a parchment or other material 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 record 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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Illustrations

All illustrations unless otherwise noted were furnished by University of Iowa Photographer F. W. Kent.

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THE PALIMPSEST

EDITED BY WILLIAM J. PETERSEN

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The Amana Meteor

As late as the beginning of the nineteenth century, some men of science ridiculed the idea that stones ever fell to earth from the sky, despite the fact that museums in Vienna, Munich, and London contained concrete evidence to the contrary. Narratives of meteors were usually received with an attitude of scornful incredulity. A special committee appointed in the year 1768 by the renowned French Academy of Sciences to investigate rumors of a "fall" in southern France returned an adverse report in spite of more than three hundred affidavits prepared by eye witnesses of the phenomenon. In 1807, when President Jefferson, who counted himself something of a scientist, was told that Professors Benjamin Silliman and J. L. Kingsley had described a shower of stones at Weston, Connecticut, he is said to have remarked: "It is easier to believe that two Yankee professors will lie than to believe that stones will fall from heaven."

Gradually, however, such a ponderable mass of

supporting evidence was accumulated that no intelligent person could longer deny the possibility of solid material falling to earth, some of which, from its very nature, must have originated from that vast outer space lying beyond the limits of our own solar system. Indeed, one hypothesis assumes that the earth was built up, little by little, in the course of billions of years, through the gradual accretion of planetesimal bodies of varying size, about a central nucleus.

By the beginning of the fourth quarter of the last century, most people of learning were familiar with the accepted tenets of science. With the spread of higher education, superstition gave in to reason and natural phenomena became subjects of scientific interest instead of the manifestation of supernatural forces to be feared. In Iowa the total eclipse of the sun in 1869 particularly had been a marvelous lesson in astronomy which gave the sciences a tremendous popular impetus. Meteors, or "shooting stars," as they were frequently called, were no longer viewed as uncanny and mysterious except by those who were inclined toward superstition or religious fanaticism.

One night in the winter of 1875 a marvelous spectacle appeared in the heavens over Iowa which created such a profound impression upon those who were privileged to witness the phenomenon that the memory of it has never been erased from their consciousness. The winter, cold-

est for many years, had been especially notable for its heavy snowfall, pearly moonlight nights, and exhilarating atmosphere. Temperatures ranging to twenty degrees below zero were not infrequent and frost had penetrated the ground to a depth of nearly five feet in some places. Between the hours of ten and eleven on the night of Friday, February 12, 1875, many people in southeastern Iowa were returning to their homes from social engagements and the highways were gay with sleighing parties.

Suddenly, without a moment's warning, there appeared in the southern sky a bright light from which emerged a great ball of fire. Shooting across the sky in a northern direction with tremendous velocity, it lighted up the whole earth as by a flash of lightning except that a reddish and then a greenish tint was imparted to objects. To one observer, it appeared as if "the face of the moon had fallen off and was approaching the earth" obliquely. The moon for a moment was entirely eclipsed by the superior splendor of the meteor. To many the ball of fire appeared pear-shaped, the larger end foremost, as it should be. The color was of "red hot iron, verging to a white heat," and many persons saw sparks flying from it as it passed. Following the phenomenon, reverberating along the path of flight, was a rumbling roar, comparable to the passing of a heavy train over a trestle bridge, and several sharp

detonations varying in intensity according to the position of the hearer.

The passing of the meteor came about so suddenly and so unexpectedly that every one seemed stunned by the spectacle. The shock sent the revellers hurrying to their own firesides, as if to await the approach of some impending catastrophe. Those who were near to the line of flight were thoroughly frightened, for the fire-ball, hurled into space apparently from the battlements of heaven, "seemed to come down upon them with a rapid increase of size and brilliancy." Horses reared and plunged to escape, while dogs went howling and barking to places of safety.

"An instantaneous bright light, filling the whole heavens, shone about us, almost blinding us," wrote J. A. Donnell in the Sigourney *News*. "This was followed by a quivering or shaking light, which continued for about two seconds. It seemed to be a combination of zig-zag and sheet lightning, the light being both vivid and diffuse. I stood still, instinctively looking upward. A globe of fire with lines of pale light radiating therefrom appeared to be falling towards the earth from a point about 10° west of the zenith. I could see it drop through a succession of clouds until it came apparently inside of the dome above me, and then for a moment it stood apparently still, and flashed and sparkled like a firebrand. Within a second afterward it started through the atmosphere like

a sky rocket, crossed the meridian in the direction of the North Star, and then continued its descent more slowly in the same line until it finally disappeared about 10° above the horizon at a point about 20° east of north."

According to C. W. Irish, a civil engineer who made an extensive and careful investigation of the appearance and course of the meteor immediately afterward, the solid portion at the head was "enclosed in a pear-shaped mass of vivid white light" fringed with deep red blending with the white and marked by flashes of green, yellow, and other prismatic colors. To observers who stood in front of the meteor, the mass of light appeared round in shape, but "fringed with rays of white and red light" that gave it the appearance of being surrounded with a halo, the rays of which darted out from the center of the head in all directions. The train of the meteor, estimated to be from seven to twelve miles in length, was principally white, though red near the head and edged with yellowish green. From the body of the meteor burst clouds of smoke or vapor "like puffs of steam from the funnel of a locomotive, or smoke from a cannon's mouth," which were suddenly whisked into the space behind, giving evidence of the rush of air into the vacuum caused by the tremendous velocity of the flying mass.

Nearly five minutes after the meteor had flashed out of sight, observers near to the south end of its

path heard "an intensely loud and crashing explosion" from the point in the sky where they first saw it. Mingled with and following this deafening explosion came a "rushing, rumbling and crashing sound" that seemed to proceed along the course of the meteor, punctuated at intervals, as it rolled away northward, with the crash of distinct explosions much greater in volume than the general roar of the continuous sounds. This commotion of noise grew fainter as it continued until it died away in five explosions from the direction in which the meteor was last seen.

But to witnesses near the north end of the meteor's track the succession of sounds was reversed. About two minutes after "the dazzling, terrifying and swiftly moving mass of light had extinguished itself in five sharp flashes, five quickly recurring reports were heard. The volume of sound was so great that the reverberations seemed to shake the earth to its foundations. Buildings quaked and rattled, and the furniture that they contained jarred about as if shaken by an earthquake; in fact, many believed that an earthquake was in progress. Quickly succeeding and in fact blended with the explosions came hollow bellowings, and rattling sounds, mingled with clang, and crash, and roar, that rolled slowly back southward as if a tornado of fearful power was retreating upon the meteor's path."

The meteor was visible as far away as Omaha

and Chicago, from St. Paul to St. Louis, the latter place being two hundred and fourteen miles distant from the point where the meteor first appeared. At Mount Pleasant the final explosion was observed as a "brilliant pyrotechnic display" low on the northern horizon. The roar, as of a strong wind, was distinctly heard at a distance of more than fifty miles, while the noise of the explosions carried fully seventy-five miles from the point where the meteor disappeared. Some people thought a boiler had burst, others ran upstairs to see if the plaster had fallen, and one woman, imagining that her house was on fire, rushed outdoors declaring that she had seen red-hot bricks falling past her window.

As is natural in the description of any event of similar character, occurring so suddenly and lasting at most but a few seconds, considerable discrepancy occurred in the narratives of the observers. Much of this was due to the various geographical positions of the individual witnesses, as well as to their temperament, intelligence, and education. Under the most favorable circumstances two persons may not see the same thing exactly alike, even though each may be equally sincere and confident as to the accuracy of his own observations. But on one fact there was very general agreement: the meteor appeared between ten-twenty and ten-thirty at night.

Observations on all other factors pertaining to

the meteor, such as size, course, elevation, color, brilliance, sound, and detonation, were necessarily dependent upon, and consequently vary with, the location of the observer. To many the fire-ball appeared to be as large as the moon while others thought it was two or three times as large. Similar discrepancies as to the other characteristics can usually be explained by the position of the witness, if some allowance is made for natural inaccuracy of human observation. For example, although the meteor actually disappeared about five miles northeast of Marengo, a news dispatch from Dubuque reported that a "brilliant meteor flashed through the heavens last night, and appeared to strike the earth within the city limits, on the bluffs, in a southerly direction. The light produced illuminated the city with a bright glare, dazzling to the eye, as it penetrated dwellings through windows and lasted for a moment. The ball of fire appeared to be the size of a small balloon or a person's head. Skeptical individuals hastened home considering the visitor a bad omen."

The light of the meteor, from first to last, was exceedingly brilliant. At the southern end of its course the first flash was blinding even to those who were looking away from the point where it appeared. Very few actually saw the meteor at its first contact with the atmosphere because their eyes were overpowered at once. People instinctively turned away or put their hands over their

eyes, and so the fire-ball sped on its way for a second or two before it was observed. At one town a group of people facing a church saw the building enveloped in a sheet of flame from steeple to foundation and thought it had been struck by lightning. Thus hundreds of persons were attracted by the unusual appearance of objects and continued to look at the strange scene without seeing the meteor itself. Near the north end of the meteor's path, according to C. W. Irish, "the light was so intense that at the final flash the eyes impressed by it were totally blind to all impression of light for several seconds after." The moon and stars, though shining brightly at the time, "were utterly blotted from the sky, and the surrounding landscape illuminated as if at noon-day."

Concerning the path of the visitor through the heavens, there was much conflicting testimony, even when the location of the various observers was considered. At Mount Pleasant numerous people stated that the meteor was first seen in the southeast passing swiftly toward the northwest, while at Fairfield, about twenty-five miles westward, it was reported to have appeared in the southwest passing toward the northeast. Obviously one of these reports must have been in error. Scientists proceeded to gather data regarding its course and direction. Professor N. R. Leonard of the State University of Iowa, determined that it travelled from southwest to northeast at an angle

of about 18° with the meridian. The course could be approximately marked on a map, he thought, by a line drawn through Agency City and South Amana. The altitude of the meteor above Ottumwa he estimated to be about sixteen miles.

In determining this difficult matter it seems that even scientists failed to agree absolutely, for Professor Gustavus Hinrichs, writing in *Popular Science Monthly* and basing his conclusions upon the careful work of C. W. Irish, stated that the meteor in coming in contact with the atmosphere of the earth became first visible at an "altitude of 150 miles vertically above the little village of Pleasantville in northern Missouri. Descending at an angle of about 45° towards the earth's surface, it moved a little east of north, gradually deviating more and more toward the east, so as to describe a curve, the concavity of which is turned eastward. The track of the meteor passed a couple of miles east of Centerville and Moravia in Appanoose County, Iowa; almost directly over Eddyville on the Des Moines River; crossed almost diagonally the northwestern (Prairie) township of Keokuk County; passed one and a half miles east of Marengo in Iowa County, and finally exploded over a point three miles southwest of the little station of Norway on the Chicago & Northwestern Railway, over the boundary line of Benton and Iowa counties at an altitude of about ten miles." This seems to be the most accurate description available. The

total length of the visible path was about two hundred miles which was traversed in approximately ten seconds.

While the meteor was crossing the northwestern corner of Keokuk County, it was seen to divide into two parts, one portion deflecting somewhat eastward but soon losing its brilliancy, and a seven to fourteen times brighter part continuing on its course until the final explosion. The fainter portion produced a meteoric shower in Iowa and Amana townships of Iowa County, many pieces of which were subsequently recovered; but no fragment of the brighter portion which exploded farther north has been found. This may be explained by the modern theory that the brilliant illumination of meteors comes, not from the surface of the stone, but from a gas cap pushed along in front and heated by the terrific friction and pressure. If this is true, the main mass of the Amana meteorite may have been thrown back at the time of the first explosion and descended as "glowing coals," while the dazzling gas cap was carried on at increased velocity by a relatively small fragment which eventually reached the earth in pieces no larger than marbles.

Interest immediately centered upon locating the spot where the meteor struck the earth and the discovery of fragments if possible. There were many guesses as to where the "glowing coals" had descended, most of them quite erratic. The first

fragment was found by Sarah Sherlock on her way to school about two miles west of Homestead. This meteorite weighed seven pounds and six ounces. Immediately scientists and others hastened to the vicinity of Homestead and the search began in earnest but without much success. It was not until the farmers began cultivation in April and May that numerous small stones were discovered, most of them weighing less than ten pounds. Fragments recovered in the timber were located by observing broken twigs and scars where the flying particles had struck the trees. The meteorite field was approximately three miles wide and five miles long extending south of the Iowa River and southwest of Homestead.

Meanwhile C. W. Irish, influenced by mathematical computations, had instituted a futile search north of the river. In the spring, however, the two largest meteorites recovered were unearthed in a field just south of High Amana. One piece weighed seventy-four pounds and the other forty-eight. Both had penetrated the frozen ground to a depth of about two feet. In the course of two years and a half over eight hundred pounds of meteoric stone had been recovered and distributed all over the world by collectors and men of science. Some went to European museums. Two large stones and numerous small ones are deposited by the Amana Society with the University of Iowa.

BEN HUR WILSON

The Forest City Meteor

By the frequent appearance of meteors the people of Iowa became accustomed to such phenomena and so educated in respect to their true significance that the passing of a great meteor was no longer viewed with fear and apprehension but rather with a lively interest and curiosity. This greatly aided scientists in their subsequent investigations carried on within the meteoric field for the purpose of ascertaining the course, orbit, and other vital information pertaining to meteors.

During the spring of 1890, northern Iowa experienced singularly good weather: the snows of a rigorous winter had receded before the advancing sun and the frost was rapidly coming out of the ground. The second of May found the farmers going about their usual duties, the larks were nesting on the prairie, buds were swelling, and the atmosphere of spring was luring people out of doors.

Late in the afternoon, when the sun was hanging low in the western sky, little more than an hour above the horizon, many farmers were coming in from the fields preparatory to commencing their evening chores. Women and children were bringing in the cows, when suddenly a great fire-ball

appeared in the west, eclipsing for a moment the sunlight of an almost cloudless sky. Travelling at incredible speed from the southwest came the roaring meteor, "sputtering" and throwing off a long train of sparks. The dazzling head, likened to the moon in size, left a heavy line of black smoke in its wake, distinctly marking the meteor's course through the heavens.

The velocity of the fire-ball was such that, as viewed by faculty and students from the campus at Grinnell College, where a baseball game was in progress, only a few seconds were consumed in its passing through the earth's atmosphere. The entire course of the meteor, from the spot where it first appeared in the heavens until it passed below the horizon, was marked by a "ribbon of smoke, having straight, sharply defined edges." Fully ten or fifteen minutes, according to the station of the observer, was said to have elapsed before the smoke column began to curl gradually away and finally became invisible. This ribbon of smoke "tapered off towards the higher atmosphere, showing the great rarity at that elevation."

Few meteors have been more widely observed in their passage, perhaps on account of the time of day and the ideal weather conditions existing at the time. Authentic reports came from Des Moines, Mason City, Fort Dodge, Emmetsburg, Algona, Ruthven, Humboldt, Britt, Garner, Grinnell, Sioux City, and other points outside of Iowa.

The meteor was observed at Chamberlain, South Dakota, at a distance of more than three hundred miles from the spot where it finally landed. For many miles around Winnebago County, the noise was likened to heavy cannonading, accompanied by a "rushing sound" or "unearthly hissing and a noticeable tremor which caused citizens to fly from their houses to inquire the cause."

The meteor descended at an angle variously judged to incline from 50° to 55° with the horizon, and to the eye its course was apparently from the southwest toward the northeast, its fiery "comet-like" tail appearing to be from 3° to 4° in length. The final explosion occurred over Winnebago County, about eleven miles northwest of Forest City. An area some three to four miles in length and from one and one-half to two miles in breadth was showered with meteorites. Although this meteoric field was adjacent to the new town of Thompson, it was readily accessible from Forest City, the county seat. Inasmuch as most of the publicity emanated from the latter place, the meteor became known as the Forest City meteor, though Thompson would be more accurate.

As usual there was some discrepancy in determining the exact time of the fall, due probably to variation in the timepieces of individual observers. Some said that the meteor arrived at 5:15 o'clock and others fixed the time as much as fifteen minutes later.

According to Joseph Torrey and Erwin H. Barbour, who first reported the event in the *American Journal of Science* in 1890, it appears "that the phenomenon was rather in the nature of a meteoric shower, judging by the appearances and the fact that several complete meteorites of considerable size were found at long distances from each other with a number of smaller ones." Of the larger meteorites, two were found weighing approximately four pounds each, one of ten pounds, another sixty-six, and the largest eighty-one pounds. Several hundred smaller pieces scattered over the meteoric field were recovered, ranging in weight from less than an ounce to almost a pound.

A few small meteorites may have fallen across the state line in Minnesota, but it is not definitely recorded that any such were ever recovered. Another so-called "Kossuth County Aerolite," which was purported to have fallen in the adjoining county, figured prominently in the early reports. This stone, which weighed one hundred and four pounds, was sold to speculatively inclined parties in Forest City, but was subsequently discovered to be nothing but a granitic boulder, commonly called a "nigger-head," so abundant in the glacial drift of that region.

The Forest City meteorites were typically chondritic, the common stony-iron type. Practically all pieces were covered with a dark reddish-brown coating or incrustation formed by fusion, the re-

sult of the friction of the meteoric material with the atmosphere of the earth.

Contrary to popular belief, the meteorites were not hot when they reached the earth. While their surfaces undoubtedly became heated to a state of fusion, the duration of their flight through the air was so brief that the interior portion remained at approximately the same extremely cold temperature of outer space, and thus the surface cooled almost instantly after the final explosion when the velocity was greatly reduced. The sixty-six pound mass, which buried itself more than three feet in the hard prairie soil, was not hot when removed the next day, "notwithstanding all reports to the contrary." A geologist who visited the spot shortly afterward reported that "the clay around it was neither baked nor in any way changed;" and that the eighty-one pound stone "fell on old turf, where last year's grass remained dry, and after the stone was taken out, grass carried down by it adhered to the surface unburned."

One of the smaller meteorites, about as large as a cake of soap, which fell upon a straw stack, did not ignite it, and the boy close by who picked it up immediately dropped it, saying that it was "so cold that it burned his hand." At one place the falling fragments bombarded the roof of a farm house like "stones of hail." Many of those who resided within the meteoric field said they detected the odor of sulphur.

Newspapers throughout the surrounding country carried reports of the meteor and persons most interested in scientific pursuits were at once alert for information that might lead them to the exact location of the meteorite. To a Norwegian farmer named Hans Matterson who lived in the neighborhood must go the credit of turning in the earliest reliable information, for within a day or two after the meteor was seen he brought to Forest City a few broken fragments and left them on display at a local hardware store. In thrifty Norwegian fashion he had "pounded them open with an ax in search of silver." In this he was apparently justified, for the stones "contained fine specks and filaments of bright nickel-iron much like silver in appearance."

Matterson said that a neighbor, Peter Hoagland, had found a stone "as large as a water-bucket." About this time, Horace V. Winchell, assistant state geologist representing the University of Minnesota, arrived in Forest City and went directly to the Hoagland farm. Peter and his wife were quite willing to sell the stone.

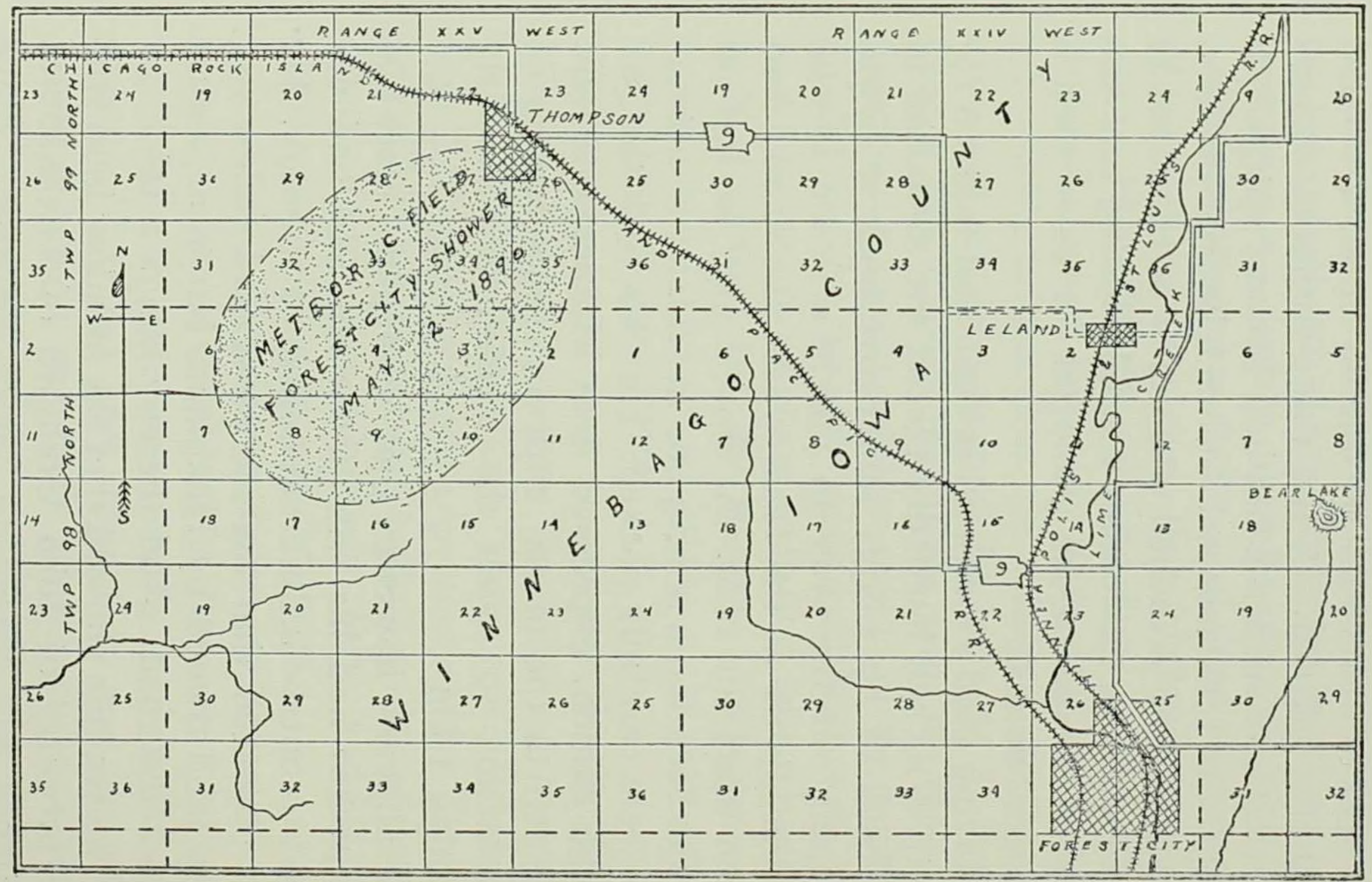
It appears that they had been embarrassed "by their inability to contribute to the cost of building a new church" in the community, and on the evening of May 2nd Mrs. Hoagland and her niece "were driving in the cattle when a cloud, making a loud noise, passed over, and out of it dropped this stone," like a gift of God, at her feet.

Before terms could be agreed upon, a second purchaser arrived. In the three-cornered dickering which ensued the bidding became spirited to a degree of recklessness. When it became evident, however, that Winchell was not to be thwarted in his desire, the newcomer ceased bidding and the stone was sold to the geologist for more than a hundred dollars.

Having paid Hoagland in cash and taken a receipt, Winchell hurriedly placed the meteorite in the back of his buggy and drove back to town, stopping on the way to purchase some of the smaller pieces at the farm where the stones had fallen upon the roof. At Forest City he lost no time in securing a strong box in which the meteorites were carefully packed. He then took the box to the station, expressed it to Minneapolis, and returned to the tavern with a distinct feeling of satisfaction to await the coming of the early morning train.

It appears, however, that Winchell's erstwhile competitor had his wits about him and had decided to pursue a different course of strategy. He had observed that the meteorite had fallen, not upon land owned by Hoagland, but in a pasture across the road. And thereby hangs a tale!

The records showed that the meadow land was the property of John Goddard of Greensburg, Indiana, and leased to James Elickson. Since quick action was imperative, a writ of replevin



FROM A MANUSCRIPT MAP BY BEN HUR WILSON AFTER A SKETCH BY TORREY AND BARBOUR IN 1891

THE GEOGRAPHY OF THE FOREST CITY METEORIC SHOWER

was sworn out in the name of Goddard and signed by his agent residing in the neighboring town of Britt. Armed with this writ, the sheriff went to the local express office in the middle of the night, took possession of the box, and removed it to a vault where it was stored for safe keeping, awaiting the disposition of the courts.

Alas! Peter Hoagland was compelled to surrender the money which he had deposited in a local bank, and no doubt his faith in the providence of the Lord was tremendously shaken, for the district court in Winnebago County decided that the stone had no owner prior to its fall, but since it actually entered the soil and became a part thereof it belonged to the owner of the land, and that the act of Hoagland in removing it, even with the consent of the tenant, was wrongful.

The case was appealed to the Supreme Court of Iowa, but before this tribunal had rendered a decision the University of Minnesota again obtained possession of the meteorite through an action of replevin and immediately removed it across the line into Minnesota, where it was thrown aboard a moving freight train which carried it to Albert Lea and thence by night express to Minneapolis. There it was buried in a vacant shed, to remain interred for nearly two years. In October, 1892, the Iowa Supreme Court upheld the lower court in the opinion that meteorites, like coal, belong to the owner of the land where they lie.

After this decision, the University of Minnesota was sued on its replevin bond in the district court at Forest City. The jury assessed the value of the meteorite at nearly five times the original value fixed by the court, which sum was cheerfully paid and the stone was deposited in the museum of the University where it still remains.

The Forest City meteorites are well distributed in various museums. Besides the sixty-six pound stone in Minneapolis the eighty-one pound meteorite reposes in the American Museum of Natural History, the Field Museum in Chicago possesses the ten-pound mass and more than seven hundred of the smaller fragments, and the Peabody Museum at Yale likewise exhibits between two and three hundred of these smaller pieces. Through various channels of exchange, many of the smaller specimens have found their way into private American collections and European museums.

Both the Forest City and the Estherville meteors of 1879 were apparently aimed from the battlements of heaven toward the state of Minnesota, but both fell some several miles short of the target. This faulty marksmanship, however, did not deter enterprising citizens of Minnesota from obtaining some of the missiles. It is indeed fortunate the important specimens of these rare meteorites are preserved in the Middle West.

BEN HUR WILSON

The Estherville Meteor

At the north end of the public square in the small frontier village of Estherville in northwestern Iowa, a baseball game was just being concluded. It was late in the afternoon of Saturday, May 10, 1879. At the end of the game a dispute arose and the argument waxed exceedingly warm. Just as the self-control of some of the partisans reached the breaking point there was a terrific crash above. Out of a clear sky came an explosion that shook the earth, followed by a deafening, rumbling roar and punctuated by a second detonation of less violence than the first. The noise, reverberating across the valley of the Des Moines River, gradually subsided, and after several seconds became inaudible. It was as if "the gods had taken a hand in our dispute," declared one who was present.

Looking quickly up toward the west, whence came the awful roar, they beheld a strange spectacle indeed! There, against an almost cloudless sky, appeared a long trail of whitish smoke "like that coming from a locomotive when under high speed," apparently passing from southwest to northeast, obliquely with the line of the horizon and at no very great distance above the surface of

the earth. As little air was stirring at the time, this smoke column maintained its alignment in the heavens momentarily, then it slowly disintegrated and in a few minutes became invisible.

Probably no one at the ball game actually saw the meteor in its flight, because attention was not directed to it until the sound reached the earth some seconds after its passing. A few miles north of Estherville, however, S. W. Brown, being in the edge of the timber and having his eyes directed upward at the moment for the inspection of some oak trees, saw a red streak in the sky. While he gazed in amazement the explosion occurred. It appeared to him, "that the meteor was passing from west to east, and that when it burst, there was a cloud at the head of the red streak, which darted out of it like smoke from a cannon's mouth, and then expanded in every direction."

Mrs. George Allen and her brother happened to be driving across the prairie near the village of Superior in an open rig. They were almost directly beneath the exploding mass and upon looking up were astonished to see it apparently separate into three distinctly visible portions, each fragment thereafter pursuing a course independently of the others from the southwest toward the northeast. The paths of the three pieces were readily discernible by means of spectacular pearly ribbons of smoke which seemed to radiate from the point of the explosion and hang glistening in the bright

sunlight, tracing the outline of a gigantic crow's-foot across the sky.

That the flight of the meteor was equally spectacular when viewed from a distance is evidenced by a description written by Charles W. Irish, a civil engineer, who was engaged in locating and constructing a line of railroad from Tracy, Minnesota, westward into Dakota. On the afternoon of the "fall," he was driving to his camp, situated at the extreme head of the Des Moines River in Minnesota. A severe storm was approaching from the west accompanied by vivid lightning and heavy thunder. "The advancing edge of the cloud extended from southwest to northeast in a perfectly straight line, and in the sunlight was pure white, making a strong relief against the blackness of the cloud beneath." This peculiar feature of the storm attracted his attention, when he was "startled by the sudden appearance of a bright red streak in the cloud extending from overhead backward from the edge quite a distance towards the northeast, and at the same instant when this streak appeared there burst through the cloud just inside its silvery edge the sizzling body of the meteor. It was brilliantly white as the light of the sun, and dazzling in its appearance, and seemed to be puttering like iron heated white hot in a forge for the purpose of welding it."

Mr. Irish and his teamster watched the flight of the meteor breathlessly as it sailed across the sky,

"leaving a broad silvery white band drawn perfectly straight behind it," and disappeared in the distant horizon. "As it passed through and out of the cloud, it drew with it a long trumpet-shaped mass of the cloud vapor, which reached entirely beyond the straight edge of the cloud into the clear sky beyond it. In a few seconds this rolled into a fleecy cloud, which floated away eastward attached to the end of the silvery white band which had marked the meteor's path in the sky. This band curled back upon itself and floated away eastward, looking very much like a magnificent, broad, white silk ribbon floating away in the air, and disappearing from view in the course of three or four minutes."

Mr. Irish was probably seventy or eighty miles from the spot where the meteorite finally landed. He afterward met people along the Big Sioux River and in Dakota who saw the meteor at least one hundred and fifty miles to the westward. "Some of them saw it passing across clear sky, while others saw it passing through and above the clouds as I did." He told his teamster to listen sharply for sounds of explosion, for he fully expected to hear them, "but if they came at all the roar of the storm was so mingled with them that they could not be distinguished."

The resulting detonation seemed terrific, however, to those in the immediate vicinity, causing the earth to tremble, jarring doors and windows,

rattling furniture, and in some instances shaking the dishes in the cupboards. It is said that window-lights were broken in at least two houses in the neighborhood. The concussion was heard for a distance of over fifty miles and the subsequent roar, as of a powerful tornado, was of indescribable proportions, deafening and shrill, producing a sensation of terror never to be forgotten by those who heard it. The noise seemed to proceed westward, back along the path of the meteor. That the explosion occurred at considerable distance above the earth is evidenced by the fact that it was plainly visible well above the horizon from Emmetsburg, nearly thirty miles away.

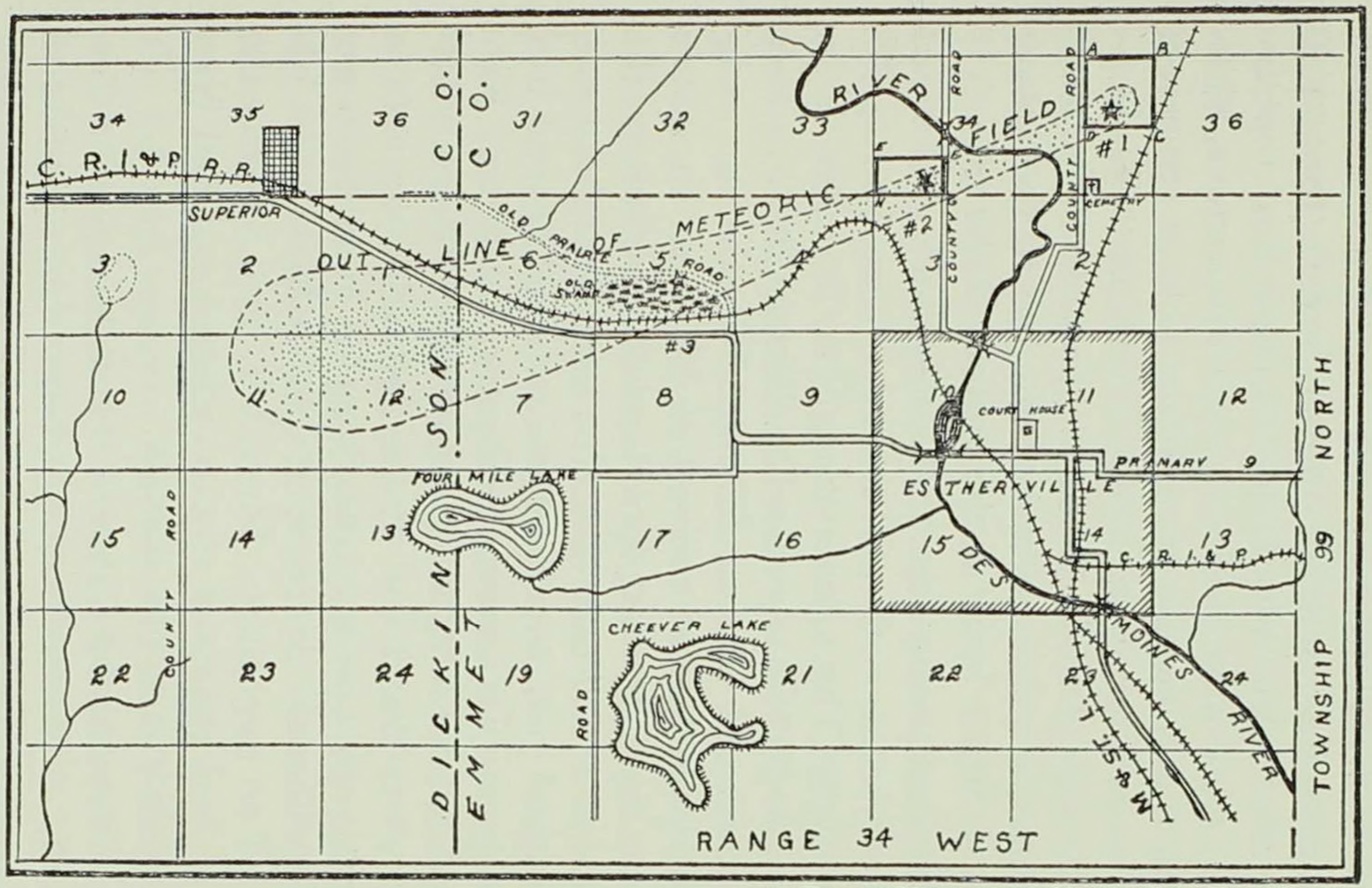
Almost the first direct testimony concerning the actual fall came from a breathless, bareheaded, barefooted herdsboy, doubtless "frightened half out of his wits," who came running into Superior, declaring that it had been raining stones out on the prairie where he was stationed, and that his cattle had stampeded in every direction. The water in the slough, he reported, had been "peppered" with fragments like hail.

Still other witnesses, noting the course of the larger fragments, observed that each apparently descended to the earth at no very great distance. Indeed, it is a singular fact that in such a sparsely settled region several individuals saw the largest piece hit the earth. Charles Ega, looking west in the direction of the report, could see nothing on

account of the sun's rays, since it was five o'clock in the afternoon, but, following the direction indicated by the roaring sound that succeeded, he saw dirt thrown high into the air at the edge of a ravine about one hundred rods northeast of where he was standing. John Barber, a pioneer farmer residing about three miles north of Estherville, was pumping water for his cattle and looked up just in time to see the flying debris about a half mile south of his place. Mrs. Sever H. Lee, the wife of a Norwegian immigrant, also saw the dirt fly over by the slough within a few hundred yards of her house.

With so many witnesses the exact location of the principal fall was soon discovered. Several boys in the neighborhood found a great hole in the ground at the edge of a shallow slough about twenty rods east of the Barber schoolhouse, on and near the southwest corner of the quarter section recently purchased by Sever H. Lee from the old Des Moines Valley Railroad Company of Keokuk. The hole was funnel shaped, somewhat irregular, ten or twelve feet in diameter at the top, with the apex of the cone pointing toward the northeast, evidently away from the direction in which the meteorite had come. Investigation showed the bottom of the hole to be filled with mud and water.

Surrounding the hole on every side, particularly toward the northeast, lay great "gobs" of earth



FROM A MANUSCRIPT MAP BY BEN HUR WILSON

THE GEOGRAPHY OF THE ESTHERVILLE METEORIC FALL

and mud, splattered about on the grass. Small fragments of metallic, ore-like stones, foreign to the material usually found in the soil of that region, were also observed upon the surface, radiating out from the edge of the hole in streamers as far as a hundred yards. These particles, however, were for the moment ignored in the more intense interest and speculation as to the nature of the larger body at the bottom of the pit.

Several young men of the neighborhood arrived on the scene early and assumed command of the situation. There were Sam, Bob, and Jim Weir, George and Charley Barber, Elmer Crumb, Elmer Barrett, and Chester Rewey. Whether they obtained the formal consent of Mr. Lee, on whose farm the meteorite had landed, to retrieve the stone is not certain. Lee was a hard-working man who had but recently come to America and had no time or inclination to dig for meteorites. Perhaps his consent to let his neighbors have whatever they could find at the bottom of the hole in the slough was inferred from his inability to express himself clearly in English. At least he offered no opposition. Moreover, until recently the land had belonged to the railroad and had been regarded as public domain.

Whatever the rights of the various parties concerned may have been, the boys began digging to secure the coveted meteorite. All day Sunday they worked in the mud, but by night had only suc-

ceeded in making a deep hole. In spite of their labor and all the ingenuity they could muster, the heavy stone was still at the bottom of the pit. Without any mechanical equipment, about all they could do was to pry up on the piece and chink under it with dirt. But it soon appeared that this was to be an endless job, for the heavy object seemed to settle back each time about as much as they had raised it.

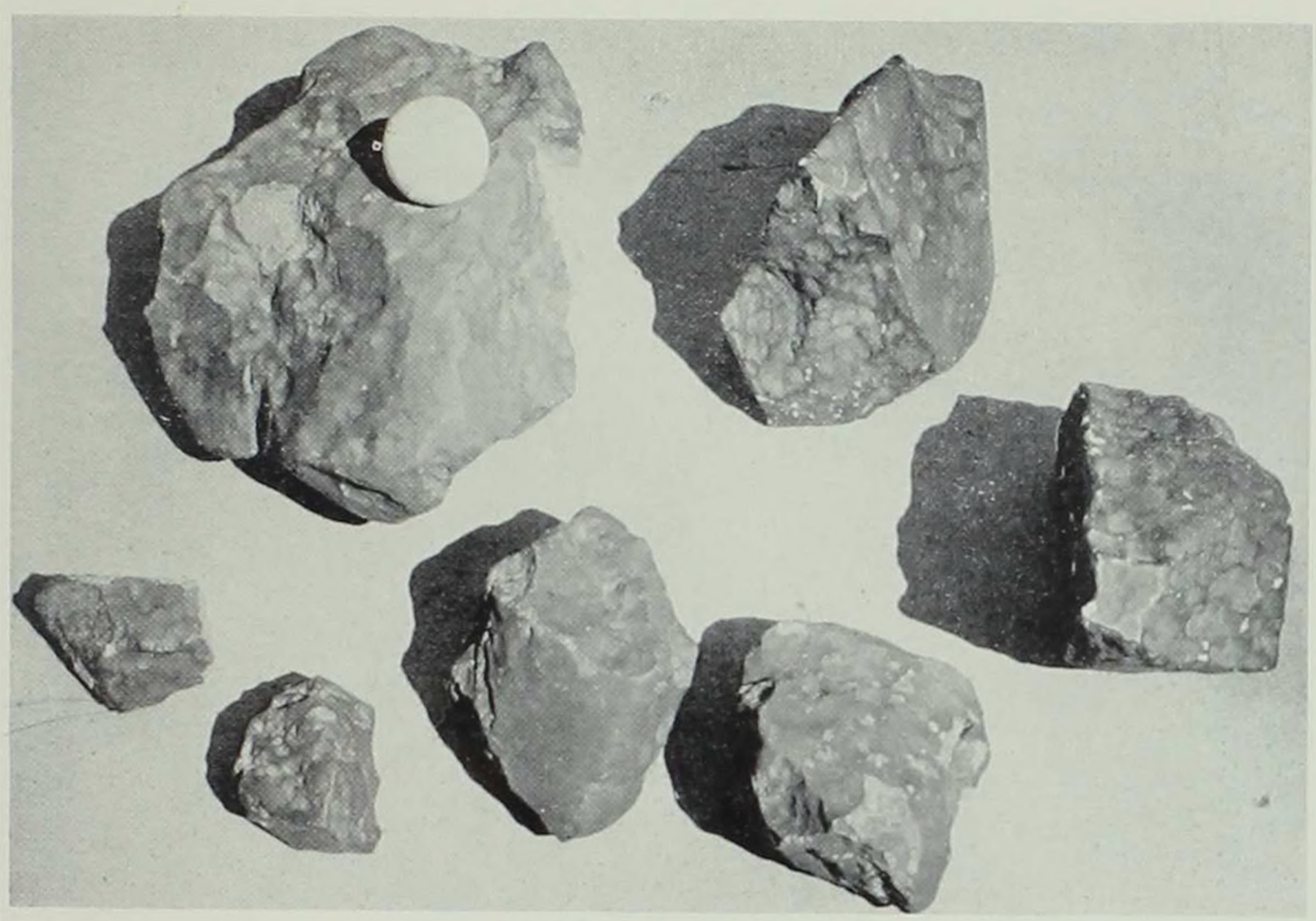
At last they decided to secure the services of George Osborn, a farmer who owned a well-digging outfit. On Monday morning Osborn appeared with block and tackle, a windlass, and plenty of strong rope. That same forenoon the editor of the Estherville *Vindicator* wrote that "there are several men engaged digging for the supposed mass, the hole having filled with mud and water. Nelt Barber has shown us a fragment that was found near the spot which is supposed to be a part of the fallen mass. It is a hard, dark-colored metallic substance, looking like molten lead, and when scraped with a strong knife reveals a bright lead-colored interior, but much harder than lead."

A day or two later the editor visited the site of the fall and reported that a piece nine by twelve inches and about three inches thick had been taken out Monday afternoon. This fragment is said to have weighed thirty-two pounds. On Tuesday "what is supposed to be the main body of the me-

teor" was recovered. It weighed four hundred and thirty-one pounds and measured twenty-seven inches in length, twenty-two and three quarters in width, and fifteen inches in thickness. The unusual depth of fourteen feet to which it penetrated was probably due mainly to the swampy condition of the soil.

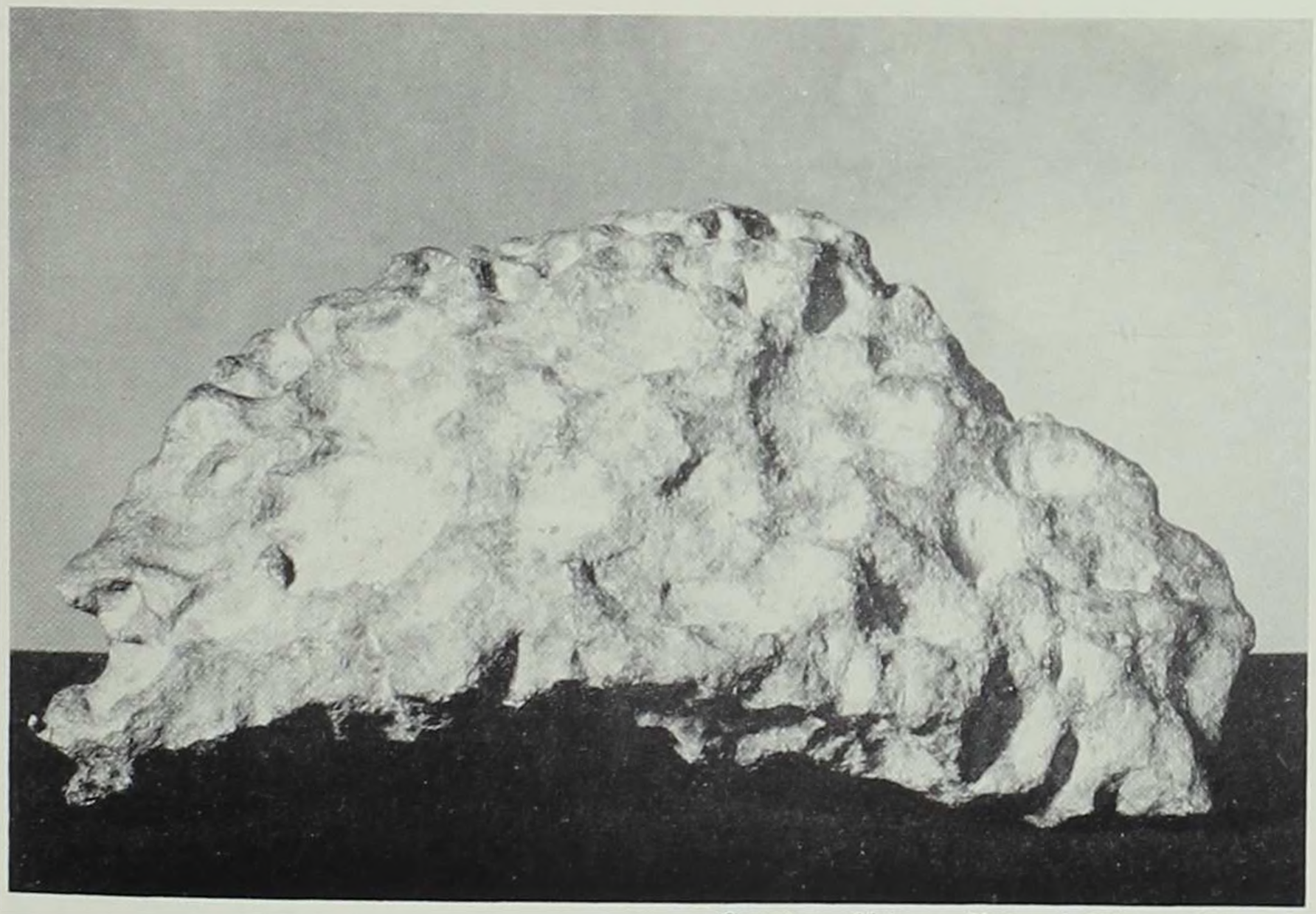
While working in the pit, Mr. Osborn's foot slipped off to one side into a deep hole at the bottom of which he declared he could distinctly feel another stone. His hip boot was filled with water on account of the accident, so he climbed out to empty it. The stone he had felt was never recovered.

The surface of the largest piece was described as "fearfully rough," with jagged projections of metal. When Osborn was asked what his services were worth he replied that if he were permitted to knock off a knob about the size of his thumb for a keepsake, that would settle the bill. But when he struck one of the knobs with a hammer, he was surprised to find that it bent to one side instead of breaking. The projection had to be bent back and forth many times before it came off. Indeed, the meteoric substance possessed almost perfect ductility, even without heating. It became quite the fashion to have rings and other ornaments made out of small fragments that were found scattered over the ground. To this day some of these relics of the famous meteor, hammered out by a local



AMANA METEOR

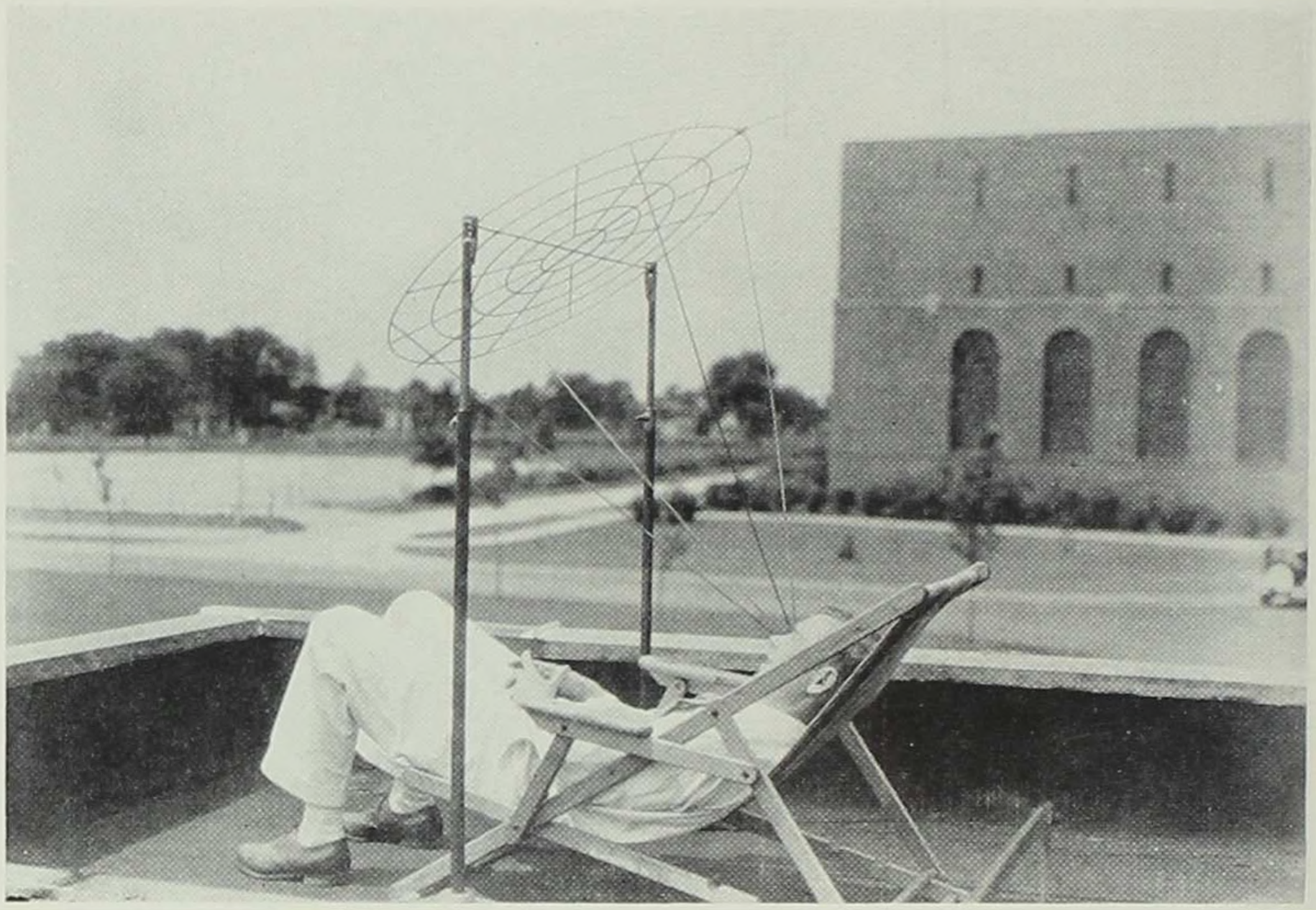
Fragments of Amana Meteor Deposited in the Geology Museum of the University of Iowa. Note size of meteors compared with baseball.



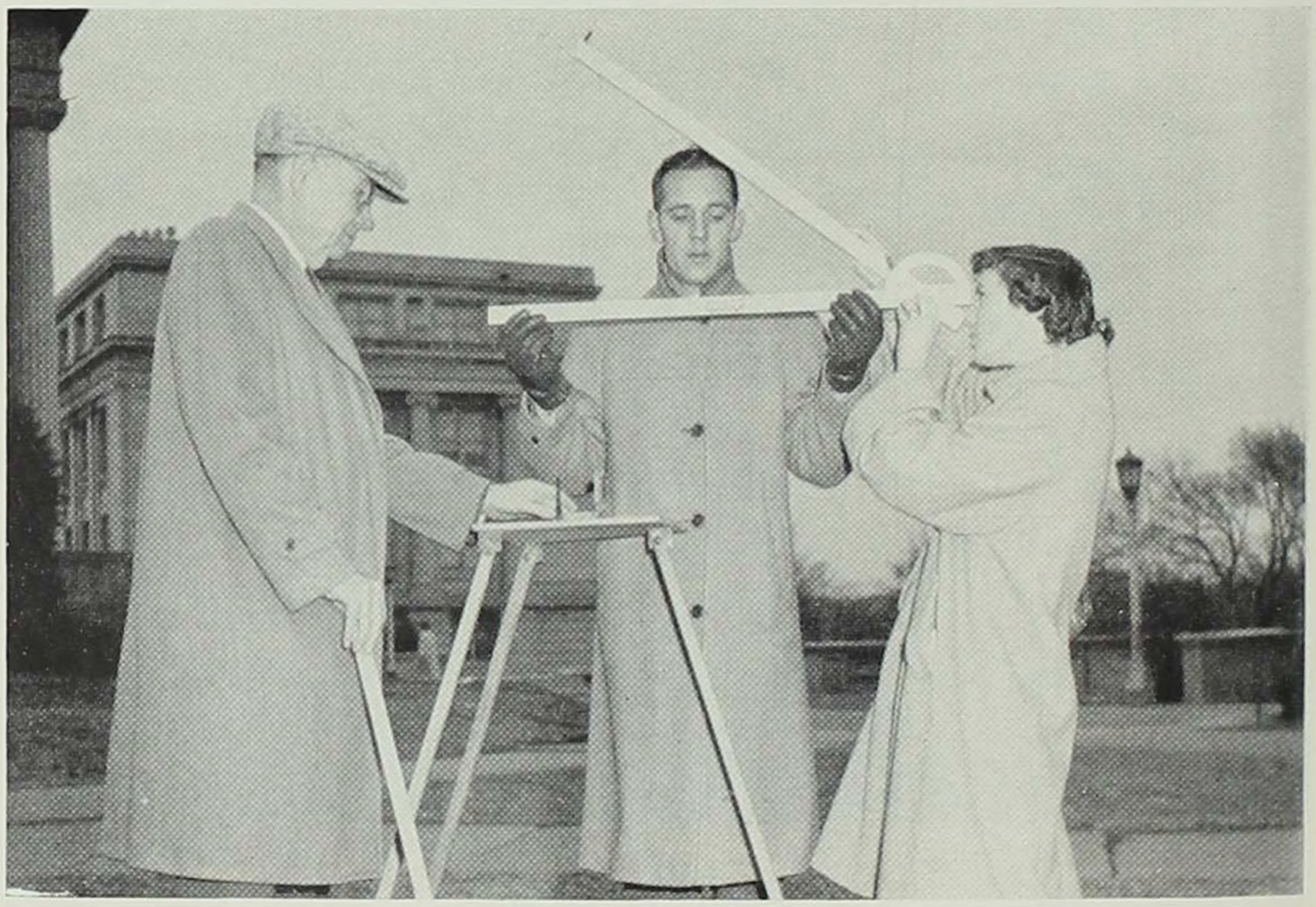
Courtesy Chicago Natural History Museum

MAPLETON METEOR

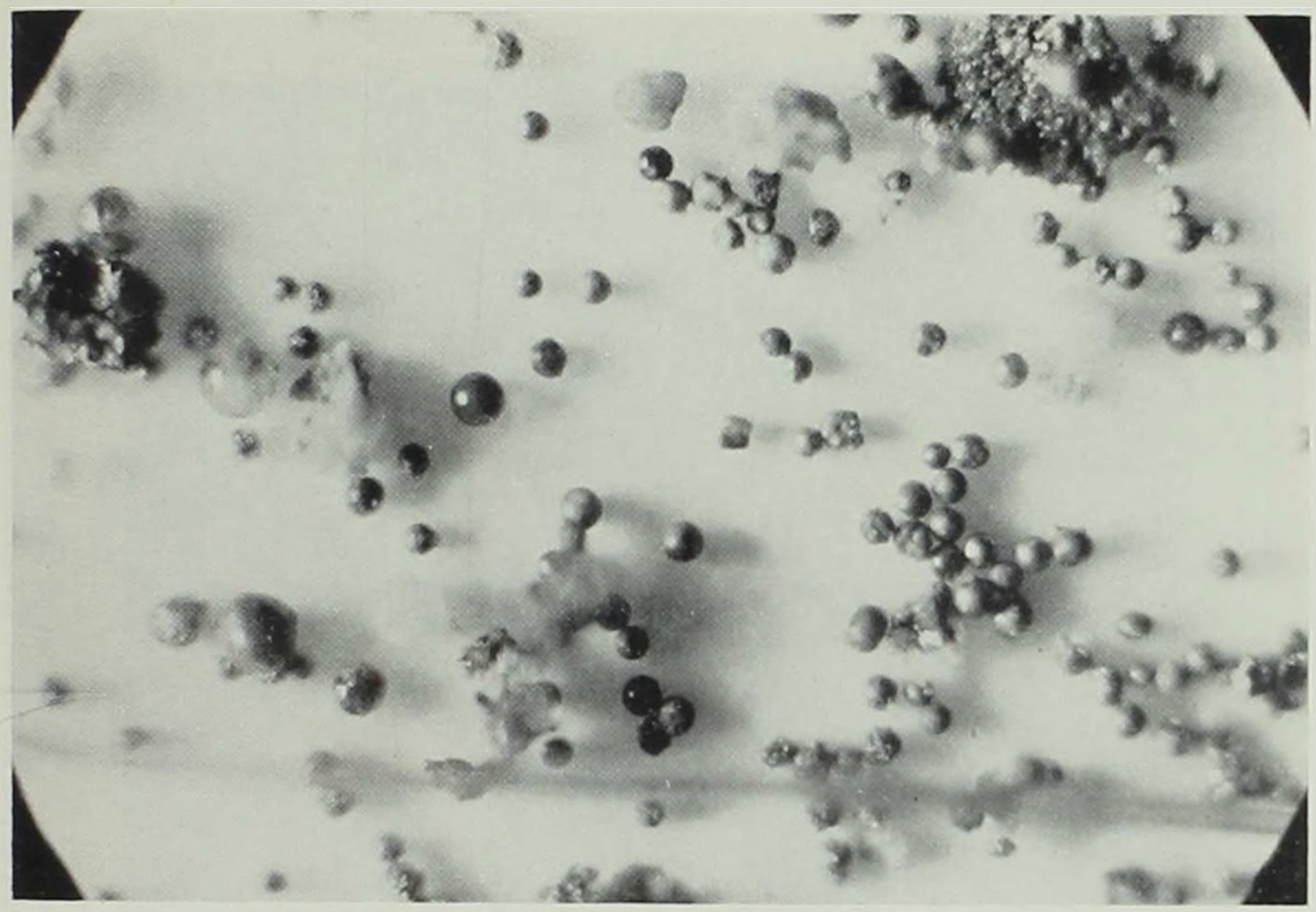
Mass of 49 kg. found June 17, 1939, near Mapleton



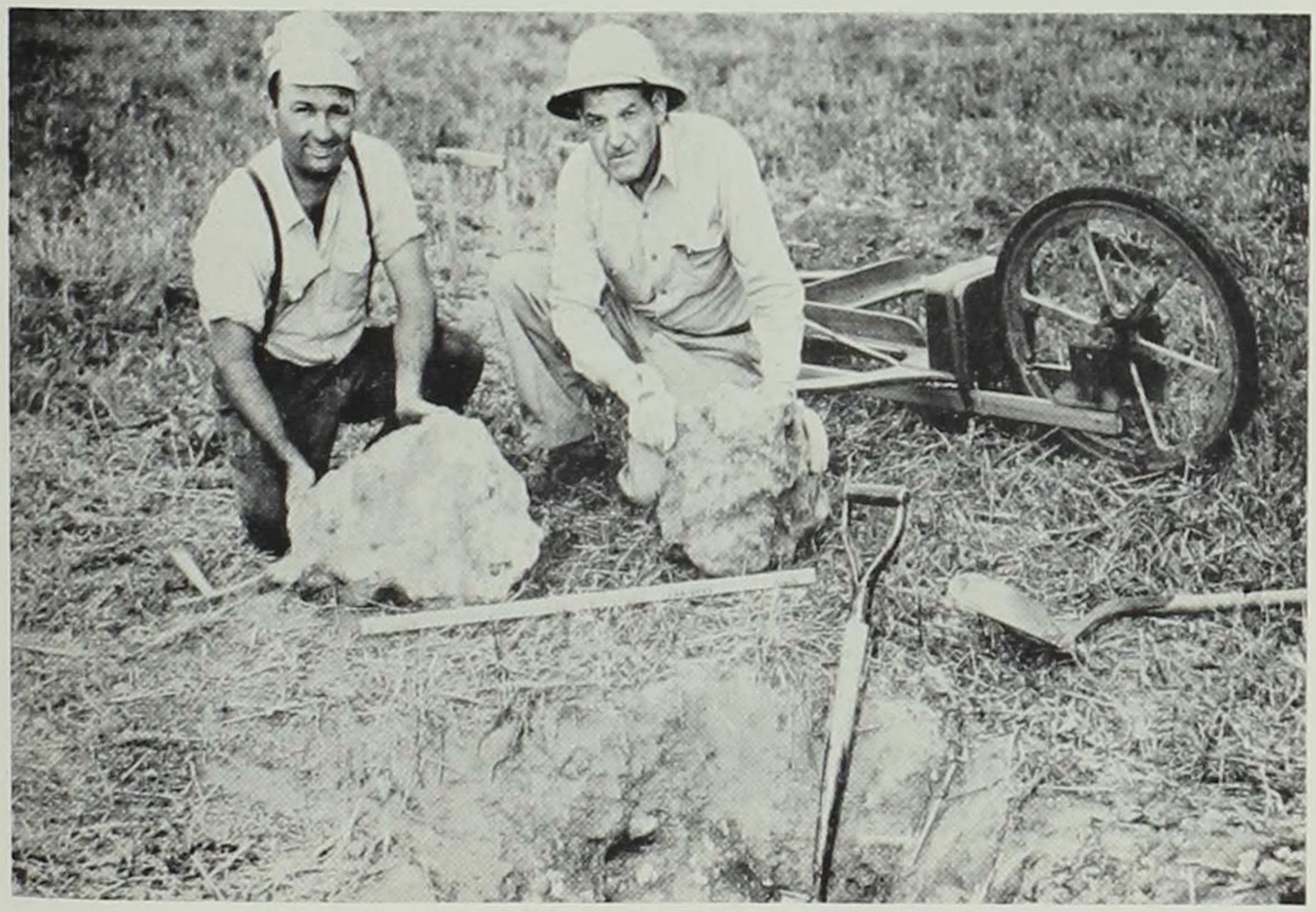
Prof. C. C. Wylie Demonstrates Simple Device to Trace Meteors Accurately



Prof. Wylie Demonstrates Equipment to University Student

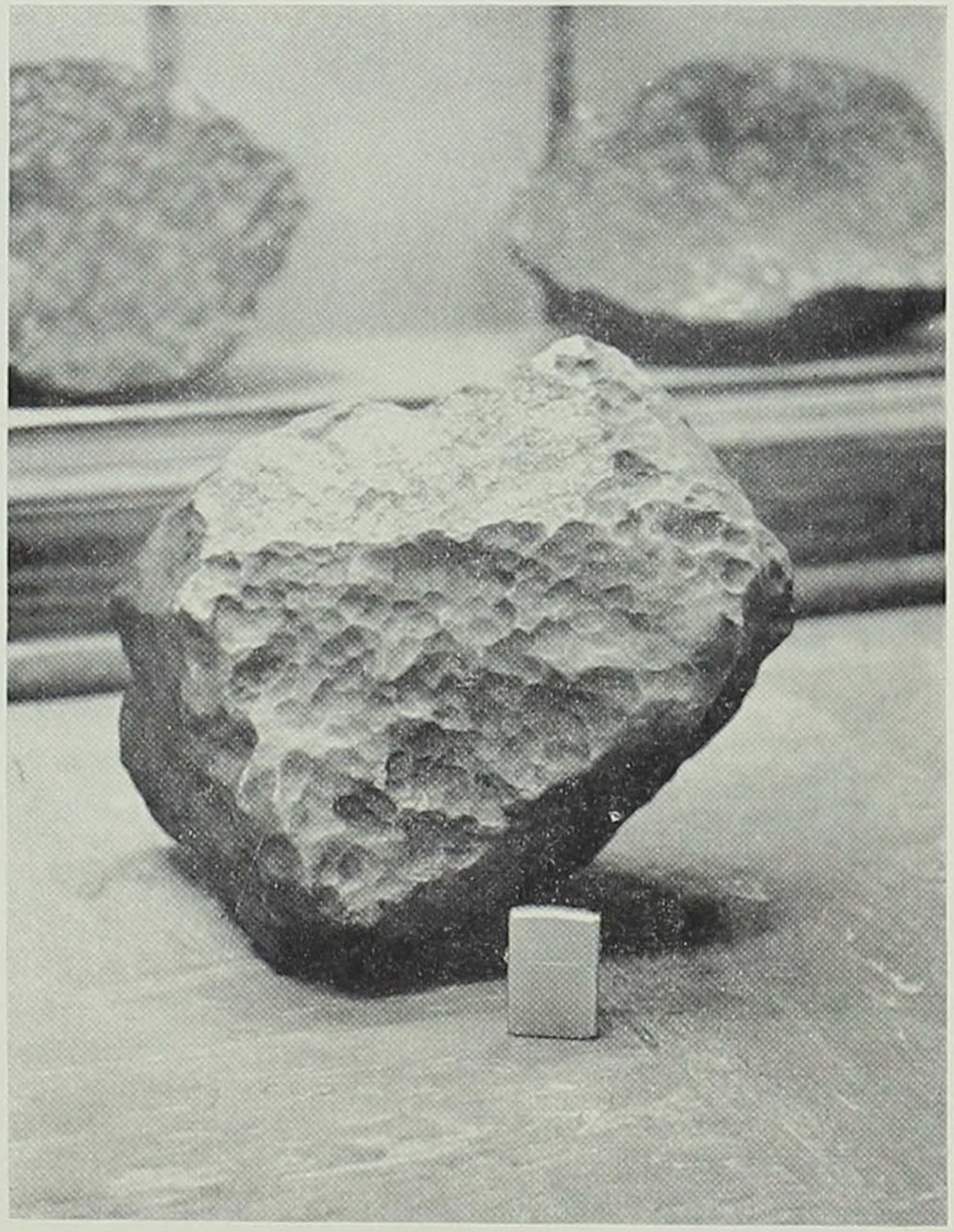


Meteor Star Dust Picked Up in Snow by University Students

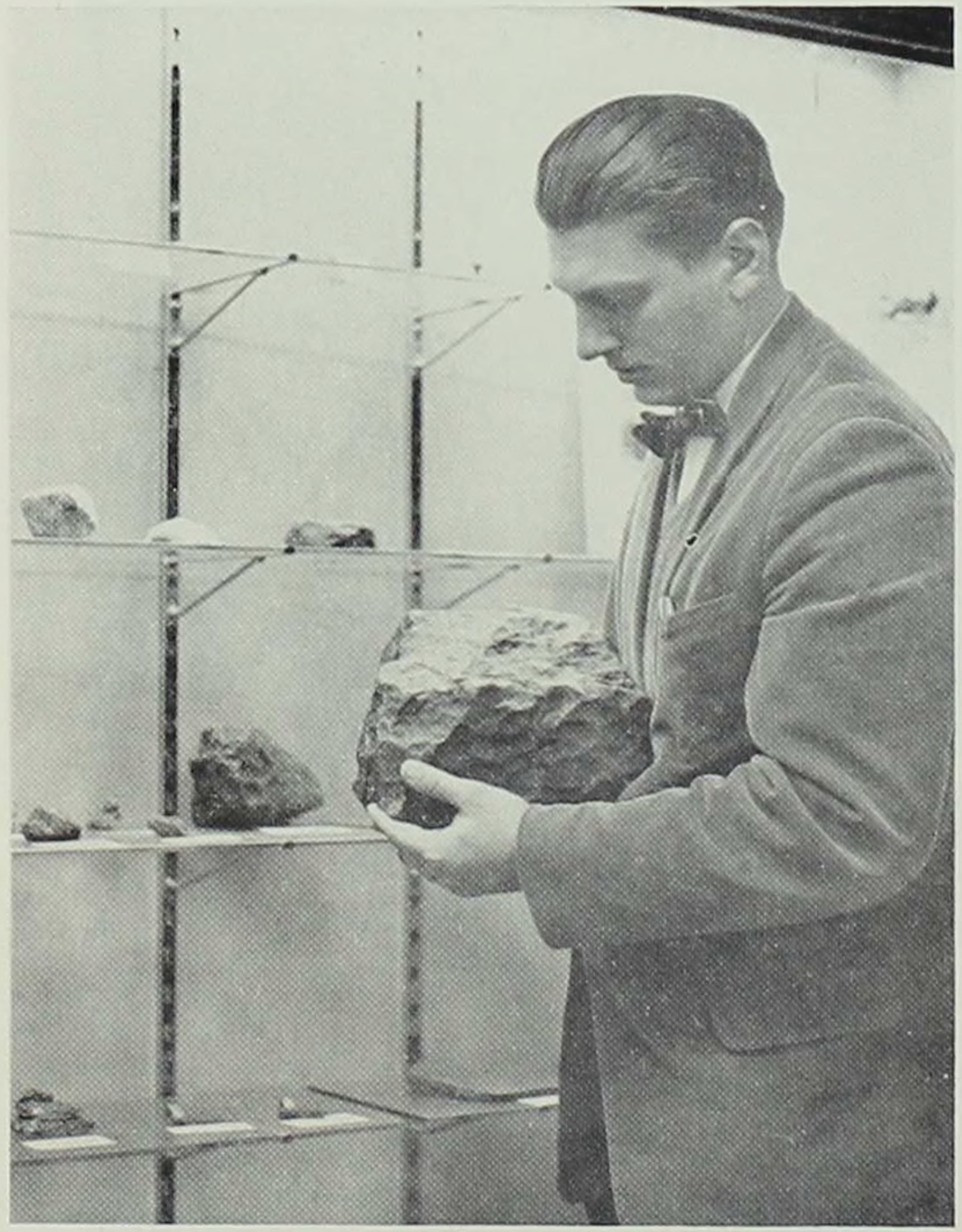


It Takes Some Digging to Unearth a Large Meteor

Forest City Meteor Finds Home at University of Minnesota



66-Pound Forest City Meteor Next to Cigarette Lighter



Photos Courtesy Mason City *Globe-Gazette*

Professor R. E. Sloan of University of Minnesota Geology Department Examines 66-Pound Meteorite

blacksmith, are still owned by Estherville residents.

The large meteorite was taken to town for exhibition. For several days the big, black stone lay on a dry-goods box in front of the Emmet House facing the public square in Estherville. There it attracted much attention and scores of people came from far and near to see it. Noticing the popular interest in the meteorite, some of the boys who found it conceived the idea of exhibiting it for money. Accordingly they put it in a strong box, loaded it in a wagon, and started out across Minnesota, proudly displaying this placard:

I am the Heavenly Meteor.
I arrived May 10th at 5 o'clock
My weight is 431 lbs.
From whence I came nobody knows.
but I am En Route for Chicago!!

The boys had not proceeded far, however, until disquieting rumors reached their ears concerning the legality of their ownership. Hastily returning, they stopped at George Osborn's place where they wrapped their prize in an old quilt and buried it in a cornfield, marking the spot by means of two pairs of stakes whose lines intersected over the place of burial. There the meteorite remained during part of the summer.

Those who had witnessed the explosion of the meteor were convinced that it had divided into at least three pieces. A search was made west of the Des Moines River and on Wednesday, May

14th, a large meteorite was found on the Amos A. Pingrey farm two miles north of Estherville. This piece, which was reported to weigh one hundred and fifty-one pounds, was about four feet beneath the surface of the ground.

The third of the three largest pieces was not discovered until the twenty-third of February, 1880, more than nine months after the "fall." As witnesses of the meteor, the Pietz brothers, who spent the winter trapping in the sloughs then so common on the prairies of northwest Iowa, had decided upon the approximate location of the spot where another piece was supposed to have fallen. One day late in February as they were going along the old prairie road beside a swamp about four miles to the southwest of the largest fall and two miles from the second one, almost in a direct line, they observed a hole in the edge of the slough. Upon sounding it with their rat spear, they detected a hard body at the bottom. Surmising what it was, they began digging and secured the stone at a depth of five feet. Smaller pieces were likewise discovered near-by. This piece closely resembled the others and was reported to have weighed one hundred and one pounds. The Pietz boys soon disposed of it to E. H. Ballard and George Allen of Estherville who afterward sold it to Charles P. Birge of Keokuk.

For some reason, Amos Pingrey, upon whose farm the second largest stone fell, failed to appre-

ciate its true value and so gave the piece to a neighbor, John Horner, who concealed it in a cave on Ab. Ridley's place. Later, when Professor Gustavus Hinrichs, representing the State University of Iowa, visited the locality and pronounced specimens of the fall to be of rare value, Mr. Pingrey regretted his generosity or carelessness and took steps to retrieve his meteorite. Thereupon Horner employed Frank Davey, an attorney and editor of the Estherville *Vindicator,* to assist him in defending his legal rights.

Meanwhile Governor John S. Pillsbury of Minnesota had sent Dr. E. J. Thompson, then a professor in the University of Minnesota, to obtain as much of the meteorite as possible for the cabinets of the University's museum, in which the Governor was tremendously interested. Provided with considerable cash and the Governor's check in blank, Professor Thompson appeared at Estherville in company with George Chamberlain, editor of the newspaper in the neighboring town of Jackson, Minnesota, who was a good friend of Editor Davey of Estherville. This proved an excellent stroke of business strategy. In company with Horner, the three made rendezvous at Ridley's cave in the middle of the night, where the "celestial visitor" was produced for inspection. A bargain was struck and a bill of sale executed, without Professor Thompson having to resort to the Governor's check. Thus the state of Minnesota

obtained possession of an object of great scientific value which might otherwise have remained in Iowa where it fell. This meteorite is the only large piece of the Estherville meteor known to have been retained in America.

The subsequent history of the largest meteorite is even more involved. It seems that it was removed from its grave in Osborn's cornfield about "barley harvest time." This proved to be a great mistake, for the existence of the valuable stone had by no means been forgotten.

Charles P. Birge, a Keokuk lawyer of speculative inclinations, had obtained possession of the contract with Sever H. Lee for the purchase of the quarter section of railroad land on which the meteorite was found. This contract contained a forfeiture clause in case the purchaser defaulted in any of his payments. Now it appears that Mr. Lee had neglected to make one of his payments on time and Birge hastened to take advantage of this opportunity to gain temporary possession of the land and thus obtain "color of title" to the meteorite. At any rate he bided his time until the stone came out of hiding, when he suddenly appeared.

There are several versions as to just how Mr. Birge proceeded to accomplish his purpose, but that of Frank Davey, editor of the *Vindicator* and himself an attorney in a position to obtain all the facts, seems the most plausible. According to him, Birge quietly obtained a writ of attachment and

without revealing his plans to any one he hired J. W. Ridley, who was running a hotel and livery barn, to take him to Chester Rewey's and introduce him so that he could view the meteorite. He also took Sheriff Rob Roan along "just for a social ride." After they all arrived at Rewey's and were in the presence of the meteorite, Birge pulled out his attachment papers and made the sheriff serve them. That night he hustled the meteorite out of the county before the other boys who had an interest in it could get a chance to file a delivery bond. The case was not contested.

Attorney Birge also purchased for speculation the large piece in the possession of Dr. Ballard and Mr. Allen as well as over one hundred pounds of the smaller fragments which had been gathered up over the prairie. Eventually he sold the largest piece to the British Museum of Natural History in London, at a splendid profit to himself. The British Museum sawed it into three sections, keeping the larger portion, weighing 60,512 grams, and exchanging the others — 50,488 grams going to the Musée National d'Histoire Naturelle in Paris and 23,208 grams to Naturhistorisches Museum in Vienna. The one hundred pound piece, found by the Pietz boys, as well as the thirty-two pound fragment found with the largest meteorite, seem to have disappeared, though they, too, may repose in some museum.

During the summer and autumn of 1879, par-

ticularly after the fires had burned over the prairie, hundreds of small meteorites, ranging in size from bullets to hen's eggs, were picked up in the meteoric field between Superior and Estherville. The amazing story of the herdsboy who had witnessed the rain of stones was thus confirmed. These pieces seemed to be droplets, formed as if they had fallen from the molten surface of the mass along the line of its passage.

Most of the important museums in the United States, including the Field Museum in Chicago, the United States National Museum in Washington, the American Museum of Natural History in New York, the Peabody museums at Harvard and Yale, and the meteorite collection at Amherst, are liberally supplied with small fragments of Estherville's famous meteor. Nearly a thousand pounds were gathered and distributed throughout the world; yet there remains nowhere in Iowa a single collection that is worthy of the name. Even at Estherville only a few small fragments have been kept by individuals who fully appreciate the importance of their possession. None is for sale.

During the years which have elapsed, the elements have completely filled the great hole from which the largest piece was recovered. The slough has been drained and the ground has been plowed and cropped, so that its exact location is known only approximately by the Lees themselves.

BEN HUR WILSON

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, the 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 . . . 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 sep-

arate 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, Professor 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 por-

tion 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 sizeable 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 Mapleton Meteor

At about eleven o'clock in the forenoon of June 17, 1939, Harvey Meevers, a farmer residing a few miles east of Mapleton, in Monona County, was cultivating corn in the field southeast of his house. It was his birthday and no doubt his thoughts dwelt occasionally upon that anniversary. Accidentally his cultivator caught behind a heavy object, which seemed so unusual that he stopped his team and dug it out of the ground for closer examination.

"It seemed heavier than any other stone" he had ever struck, so he put it on the back of his cultivator for a weight. Driving in from his work in the late afternoon he took it along with him. As he lifted it off the plow he came to the conclusion that "it was a mass of iron," and decided to save it, putting it in the barn for safe-keeping. After doing the usual chores he went to the house for supper. Very soon, however, a severe thunder storm came up and he remembered the large piece of iron in the barn. Fearing that it might draw the lightning, he went out immediately and carried it to a safe distance from the building.

Eventually, the object was shown to a number of friends and neighbors, and naturally their curi-

osity concerning its true identity was considerably aroused. Strangely coincident, the July issue of the *National Geographic Magazine* carried an article on meteorites, by F. Barrows Colton, which furnished them the clue needed to solve the problem. This was truly fortunate, and probably responsible for saving the specimen. Had its nature not been early recognized, it would doubtless, sooner or later, have been cast aside and eventually lost altogether. Such has probably been the fate of other finds in Iowa.

So confident was Harvey Meevers of the correctness of his identification, that he took the curious rock to town where it was exhibited in the window of the local bank as a meteorite. The specimen weighed 108 pounds, and possessed all the characteristics of "meteoric iron," including a dark brown, somewhat rust-stained surface pitted with peculiar prints known as "thumb marks," which appear as if someone had pressed his thumb at random into a plastic surface which afterward became indurated by nature. The dimensions of the meteorite, taken from careful measurements made at the time, were: length, 17½ inches; width, 9⅞ inches; and thickness, 6¼ inches.

In several respects, this was a novel event in Iowa meteoritics. The Mapleton specimen is the only authenticated meteorite found within the state, of which the time of its fall is uncertain.

The four great falls, or showers, in Iowa were actually witnessed. How long the Mapleton meteorite may have lain buried in the ground before it was discovered by Harvey Meevers can not be determined. This period may have been a few years or perhaps several hundred. Its appearance, however, particularly the lack of extensive weathering, would seem to indicate a relatively short time.

A number of people surmise that it might have been connected with a great fireball which went streaking across the sky at about ten o'clock one evening during the winter of 1916-17. The consensus of opinion seems to be "that the ground was frozen hard at the time, that some people had already retired for the night, and that it was certainly before" the United States entered the war. Mr. Meevers, himself, thinks that this occurred on Thanksgiving night in 1916. Be this as it may, the fireball was observed by a number of people in the vicinity of Mapleton, traveling apparently in a "northeasterly direction, giving off a great deal of light, and was followed by a loud explosion." An observer at Emmetsburg, some eighty-five miles northeast of Mapleton, reported that the bright light and explosion occurred southwest of his point of observation.

If this was actually the meteorite found by Meevers, it is difficult to account for the fact that it buried itself so deeply in the soil as to elude de-

tection in a field which must have been plowed and cultivated many times in the previous twenty-five years, for under such circumstances meteorites usually bounce on striking the frozen ground, rather than penetrate deeply into it. The explosion would also indicate that the meteorite must have been broken into several fragments, no others of which have yet been found.

Astronomer David E. Hadden, of Alta, Iowa, writing in *Popular Astronomy,* described a brilliant "Detonating Meteor" which went streaking across the western sky in a southerly direction at about 9:55 P.M. on the evening of May 31, 1917. At this time of the year the ground would not have been frozen, and there is the possibility that this event might have had some bearing upon the Mapleton "iron."

While the physical appearance of the Mapleton meteorite would apparently indicate that it is a complete individual, rather than a fragment broken from a larger one by an explosion, Dr. H. W. Nichols is of the opinion that its extremely thin crust, "not over 0.25 millimeter, suggests that the meteorite burst at so late a period of its fall that there was not time for any noticeable penetration of heat. If this should be the case, there is a chance for a future find of another individual within perhaps ten miles."

The Mapleton meteorite also differed from the other Iowa falls in that it was a typical "iron" or

"siderite" — the only one of this class thus far recovered in the state. The Estherville fall was of the rarer mesosiderite, "ironstone" type, and the Marion, Amana, and Forest City falls were of the more common "stoney" variety known as areolites. While on exhibition in Mapleton, a small chip for a sample was sawed off the meteorite with a hack-saw by a local blacksmith. This revealed a bright metallic interior, which confirmed the theory of the local scientist that it was composed principally of iron.

Being somewhat anxious, no doubt, to turn his new possession into cash, Meevers sent the following letter on July 22nd to the Field Museum of Natural History in Chicago.

"Gentlemen: I have recently discovered a meteorite on my farm. It is of quite considerable size, weighing 108 pounds. This, I understand, is large as meteorites go.

"I wonder if you would be interested in securing this relic for your museum, and if you would make an offer for same. I have a small chip I could send in case you would want to analyze same to determine its authenticity. Of course, I would expect to get the sample back again."

In response to this letter, Clifford C. Gregg, Director of the Museum, immediately replied to the effect that his experts would be glad to examine the sample, and notify him of the results of their findings.

In mailing the "small chip" to the Museum on July 26th, Meevers showed the utmost confidence in his own judgment of the value of the find, saying: "I am sure that your report on this sample will be that it is a genuine meteorite and that it will have considerable value as a historical piece as well as conveying some leads which will give additional information which is of interest to geologists and astronomers."

The letter containing the above paragraph and the "chip" referred to, were received by the Museum on the morning of July 28, 1939. An examination was made at once and the sample immediately pronounced to have come from an iron meteorite. Arrangements were made between Elmer S. Riggs, who was acting as Chief Curator of Geology, in the absence of Dr. H. W. Nichols, and the administrative department of the Museum "for an immediate examination of the meteorite with the view of entering into negotiations for the purchase of the same."

Consequently, on the following day, Bryant Mather, the Associate Curator of Mineralogy, accompanied by Warren Raymond, the Assistant Register, went to Mapleton, where they visited Mr. Meevers. They were very cordially received, and after assuring themselves of the authenticity of the specimen, began negotiations for its purchase. At first, Mr. Meevers seemed reluctant to consummate a sale on such short notice. He had

apparently written to other potential buyers, but thus far only the Field Museum had replied.

Before he would consent to the sale, he withdrew to consult at length with advisers by phone and with Mrs. Meevers in person. The desirability of having the meteorite preserved in the Midwest, rather than in the East where it would be much more difficult for him and his friends "to come and see it on display," was one of the deciding factors, according to Mr. Mather, which eventually "led him to accept the offer we made and to pick up the five-dollar bills we had been lining up along the edge of the porch floor."

And so, for a nominal sum, the title to the fifth Iowa meteorite, the only one to be found in the present century, passed to the Museum to become a worthy part of a collection containing the largest representation of individual falls of any collection in the western hemisphere, if not in the entire world. At the Chicago Natural History Museum, it is now on exhibition with generous portions of each of the other four great Iowa meteorites.

Upon completion of the transaction, Mather and Raymond made detailed notes concerning the circumstances of the recovery of the specimen, particularly the exact location at which it was found, which proved to be the northeast quarter of the northwest quarter of Section 15, Township 85 North, Range 42 West, about three miles east and one mile north of Mapleton, Monona County,

Iowa. By a careful comparison with available maps, Stanley E. Harris of the Iowa State Geological Survey determined this position to be 42° 10′ 47″ north latitude, and 95° 43′ 18″ west longitude, this being the location of the center of the particular forty-acre part of the section.

"It was also agreed," reported Mr. Mather, that, "we would make an effort to have notices of the finding of the meteorite placed in the Mapleton and Sioux City newspapers, to have copies of whatever publicity that might appear sent to him, and finally, to suggest that he be made a member of the Museum and sent a card entitling him to free admission." It was late in the day when the specimen was carefully placed in Raymond's car, adieus were said, and the scientists departed for Chicago, where the Mapleton meteorite was safely delivered into the permanent care and keeping of the Field Museum of Natural History (now the Chicago Museum of Natural History).

The first official notice of the Mapleton meteorite was prepared by S. K. Roy of the Department of Geology of the Field Museum and appeared under the title "Field Museum Obtains First Iron Meteorite Ever Reported for State of Iowa" in *Field Museum News* for September, 1939. In the following month, *Rocks and Minerals* also published a brief account. In both of these articles the name Mapleton Meteorite was assigned to the object.

In due time, the Museum authorities began the scientific analysis of their newly acquired treasure, which included such matters as chemical composition, specific gravity, and internal structure. In determining the latter, it is necessary to saw off a section, whereupon the flat surface is first polished very smoothly and then etched by dipping it repeatedly for brief intervals into a weak solution of nitric acid. This brings out the so-called Widmanstatten figures in relief, thus revealing the internal structure of the meteorite, by which means it is classified. The Mapleton "iron" proved to be of the type called medium octahedrite.

While the specific gravity of most "iron" meteorites is relatively uniform, this feature has incidental significance. As determined from a small section, the specific gravity of the Mapleton meteorite was found to be 7.70, which is about the average for such an "iron."

Chemical analysis, made in the Museum laboratory by Henry Herpers, disclosed the following elements present, which are given in percentages: iron, 92.16; nickel, 7.61; cobalt, 0.036; copper, 0.003; carbon, 0.14; sulphur, 0.01; and phosphorus, 0.10. These elements are all common to meteorites of this type.

Dr. Nichols did, however, state to the writer, that it was one of the toughest "irons" that the museum technicians had ever attempted to saw, and that the working blade would on occasion

apparently make little or no progress for hours at a time. This he said might possibly be due to inclusions of microscopic diamonds (crystallized carbon), of which there was a sufficient quantity shown in the chemical analysis to account for the phenomenon, but that no test had yet been made to prove the theory of their presence.

The Mapleton meteorite is now displayed in a cabinet of Meteorite Hall of the Chicago Natural History Museum where it has been assigned the catalog number Me2286. Its weight is stated as 108 pounds. There is also one fragment of 34 grams, presumably the sample originally sent in by Mr. Meevers. It was sawed into a number of sections which consist of two "end pieces," of 35.5 and 47 pounds each, and three "slabs" weighing 10 pounds, 7 pounds, and 4290 grams respectively, all of which have been retained by the museum, with the exception of 20 grams which have been exchanged with H. H. Nininger, a meteorite collector of Denver, Colorado.

Fortunately, there are many men scattered over the country, like Harvey Meevers, with a wholesome bump of curiosity in their nature who are continually uncovering new facts and new objects for science. Were it not for such individuals, the progress of civilization would have been greatly retarded. No one knows how many other such "finds" may be awaiting similar discovery.

BEN HUR WILSON

Our Amazing Universe

IOWA METEORS

From the dawn of civilization man has endeavored to fathom the mystery of the universe around him. While theologians have speculated on their heavenly home, scientists from many lands have contributed to our knowledge over the centuries. It remained for the advent of *Sputnik,* closely followed by our own *Explorer* and *Vanguard* during the International Geophysical Year (1957-1958), to catapult men's minds into such exciting exploits as space travel, journeys to the moon, and the thousand and one other amazing things normally associated with the realm of fantasy that heretofore had been reserved for such men as "Buck Rogers" and "Flash Gordon."

One of the problems facing both satellites and space-traveling man is the danger of collision with comets, those irresponsible vagabonds of space that weave among the stars like drunken drivers. More than a million comets infest the solar system, the larger ones with heads a million miles in diameter and tails a hundred million miles long. Some of these gaseous space travelers come into view only once in a thousand years, while others

(like Halley's Comet) return at rather frequent intervals.

Meteors, or shooting stars, are far more numerous than comets, since they represent the cosmic rubbish that fills the universe. Meteors constantly pelt the earth, although most of them are burned up upon entering the earth's atmosphere and never hit the ground. The great meteor craters in Arizona and Canada are among the most awe-inspiring natural phenomena to confront man. The largest meteoric fall of historic times occurred in northern Siberia in 1914. When visited thirteen years later, more than two hundred craters were found, some over seventy-five feet across. The devastation covered an area thirty-five miles square, an area equal to that of greater New York.

Between 1927 and 1944 Ben Hur Wilson contributed five meteor articles to THE PALIMPSEST which we are reprinting herein. The original interest elicited in these strange visitors from outer space has been accentuated in this important Geophysical Year. During the next decade many of the mysteries of the universe are destined to unfold before our wondering eyes. A study of the meteors that fell in Iowa during the past 111 years will give Iowans a better understanding of the universe around them.

WILLIAM J. PETERSEN

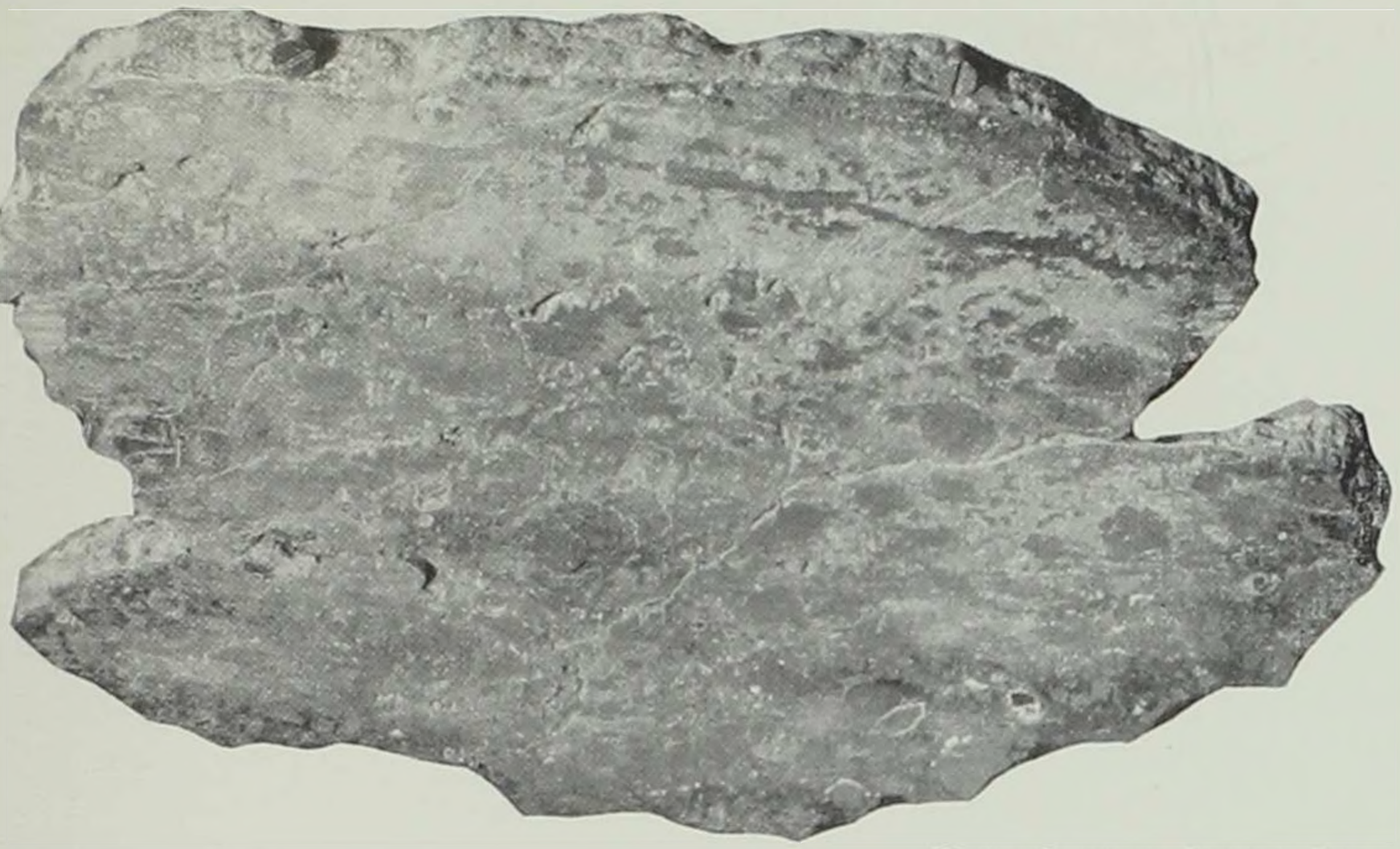


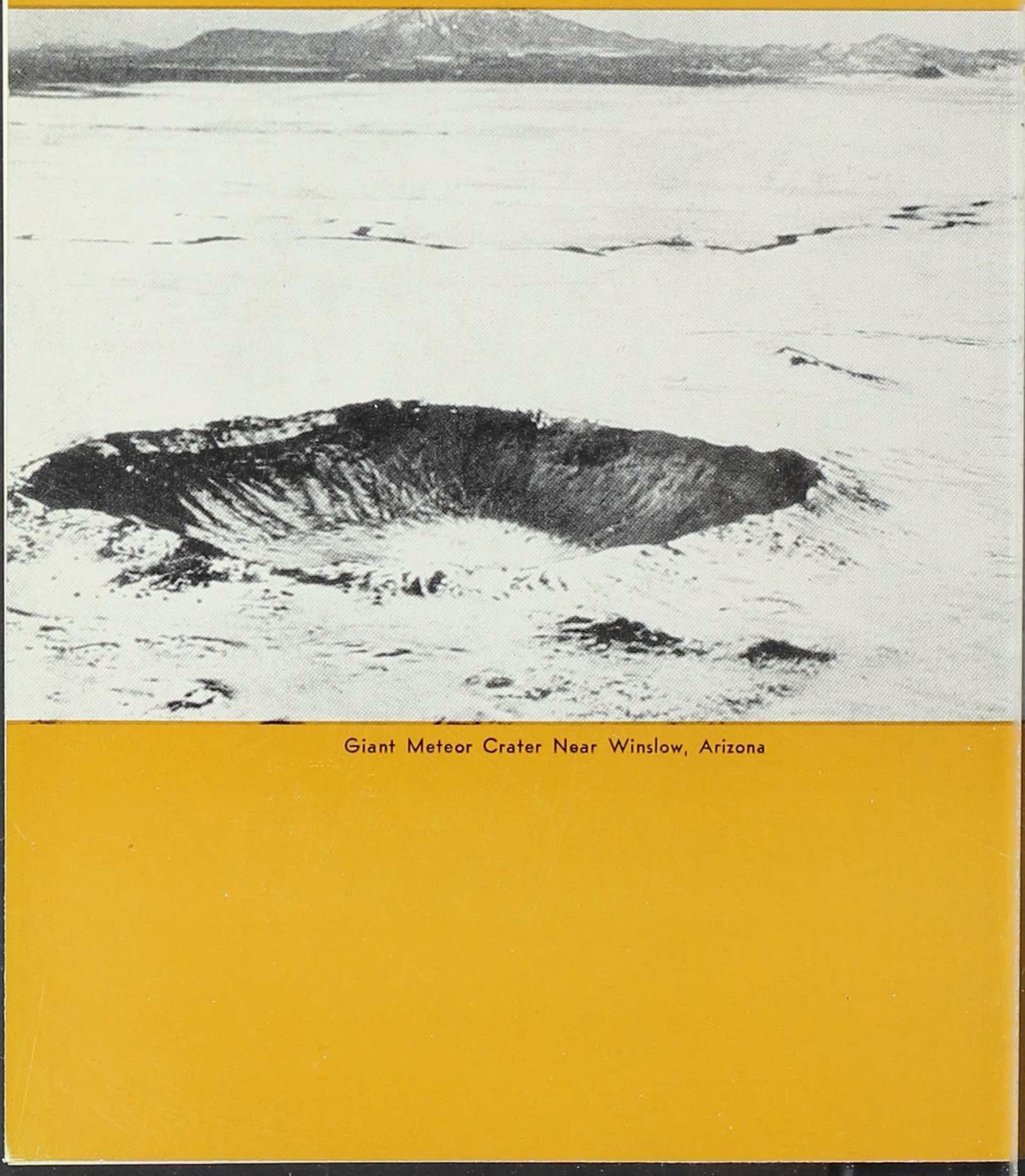
Photo Courtesy Deemer Lee

Cross-section of Estherville Meteor in Estherville Public Library

From Proceedings of the United States National Museum

Polished Slice of Estherville Meteorite at the University of Minnesota

Explanation: 1 and 2, pebble-form masses of enstatite; 3, pebble-form mass of peckhamite; 4, metal; 5, cavities



Giant Meteor Crater Near Winslow, Arizona