



• The meteorite that exploded above Kansas on February 18, 1948, made scientific history. Because of its importance, SCIENCE ILLUSTRATED asked Dr. Lincoln LaPaz, an outstanding authority on visitors from space, to prepare the following account of the Norton County stone.

When he prepared this article, the largest fragment of the meteorite found weighed only slightly over 100 pounds. But later, Dr. LaPaz telephoned SCIENCE ILLUSTRATED from Norton to report the finding of a new

section of the stone. After completing its excavation—the stone had penetrated 11 feet into the ground—Dr. LaPaz reported that it weighed over 2,000 pounds, that it was 20 times as big as any achondrite (a stony meteorite) previously recovered.

This find means that the New Mexico Institute of Meteoritics, of which Dr. LaPaz is director, as well as other scientific institutions, now have additional material with which to pursue their analyses of what happens to a body traveling through space.

ON FEBRUARY 18, 1948, at 4:55 P. M., Mrs. Orville Manning and her son, Ralph DeWester, were walking in the backyard of their home on the huge McKinley Ranch in Norton County, Kansas. Twenty odd miles west and south of the Mannings a convalescent, shell-shocked veteran was loading fodder on the farm of W. J. Yoho. A few miles south of the Yohos, Creta Carter, 11 years old, of Jennings, Kansas, was stretching up to reach a clothesline built for adults. Some ten miles east of the Mannings, the bay mares of Dale Severns'

favorite team were grazing quietly on the grassy slopes of the pasture that had been their home for many years.

Seconds later, Mrs. Manning and Ralph, petrified with astonishment, were gazing upward at an angry boiling cloud, showing an occasional reddish streak, that had suddenly blossomed out in the clear blue sky. The air around them seemed filled with unearthly whizzing sounds.

On the Yoho farm, the veteran crouched in a state of collapse while a cannonading louder than any that he

had ever heard in Europe beat down from the sky.

In Jennings, tiny Creta, undismayed by both a brilliant fireball that had flashed centrally across her field of view, and strange thundering sounds that followed its passage, was marking very carefully where the fireball had disappeared behind the town's tallest building.

On the Severns' farm, the bay mares, trapped on their sides between the precipitous walls of a narrow muddy gully into which they had blundered while racing desperately away from the deaf-





# Norton, Kansas, meteor is newest and rarest visitor from space

**1** EXPLODING METEORITES are rarely caught in the act. Here is the Norton stone disintegrating 35 miles above earth.



**2** OBSERVERS like Mrs. H. R. S. Davis, of Norton, aided in finding fragments by showing direction in which they saw explosion.



**5** SURVEYS resulted in dramatic moments like one above; Mrs. LaPaz (pointing) found meteorite fragment on Tansill farm.



**6** ACHONDRITIC substance of meteorite is extremely fragile, so fragment found, left, had to be carefully removed from soil.

ening noise, were pawing blindly toward suffocation.

Similar experiences were recorded throughout several hundred square miles in northwestern Kansas and the adjacent portions of Nebraska. Near the center of this vast territory, in Norton, Northcat, and Oberlin, Kansas, and in neighboring towns, these noises were of unparalleled intensity. Thousands of persons driven out of doors by these startling phenomena saw mushrooming far overhead clouds compared by many to those accompanying atom bomb explosions. Few of the observers actually saw the fireball whose flight across the sky was the precursor of all the tumult that followed. Unlike Creta Carter, the

average eyewitness did not have his face turned skyward at the crucial instant. Consequently, although the fireball was bright enough to be visible near Greeley, Colorado, approximately 250 miles away, it was seen only by a few.

For weeks after the startling events of February 18, the chief topic of conversation in Norton County was the nature of the fireball and the explosive noises and long enduring, high-level clouds that attended its flight through the sky. Scientists unhesitatingly advocated a meteoritical origin for these phenomena. But most of the populace, influenced by the state of international relations, attributed the "Norton incident" to a rocket or similar missile gone astray from

the White Sands Proving Ground, or directed Kansas-ward by an enemy country.

Shortly before 6:00 P. M., on February 18, an account of the Norton incident reached the Institute of Meteoritics of the University of New Mexico through Lt. R. E. Young of the Kirtland Field Civil Air Patrol office. In the next few hours additional information was secured through C.A.P. channels and long-distance calls. Then a huge volume of correspondence was carried on with actual observers of the fall in Kansas and Nebraska. Eyewitnesses were visited by Institute of Meteoritics representatives, to obtain transit measurements of the position of various points on the meteor





**3** FIRST FRAGMENT of Norton stone was found by George Tansill while harrowing a clover field with his tractor.



**4** SEARCH PARTIES organized by Dr. Lincoln LaPaz, above, used transits to locate spots where fragments may have fallen.



**7** SCIENTIFIC value of meteorite pieces caused residents of Norton County to submit even ordinary rocks for examination.



**8** RADIOACTIVITY studies of fragments are made at Chicago's Institute for Nuclear Studies by Dr. Harrison Brown (see text).

path as seen by them.

#### *Fragment of Meteorite Found*

As soon as decent weather permitted full-scale field search, an Institute of Meteoritics party entered the area in which observers' lines of sight to the end point of the meteor's path intersected. On April 28, they found a fragment of the meteorite itself in the hands of George W. Tansill, almost the first farmer interrogated in the intersection area. Mr. Tansill had picked up this fragment on April 6 and being familiar with the rocks of the area, knew at once that it was foreign to the region. However, he had to wait until the arrival of the Institute of Meteoritics party to have

his surmise that it was a meteorite confirmed. Further search resulted in the discovery of several hundred additional meteorites, mostly quite small. Still later, a mass weighing over 100 pounds was found by Ralph DeWester and Mrs. Haskell McKinley, deeply buried in an area already searched by the Institute of Meteoritics party.

These discoveries and the laboratory examination of the materials recovered showed that the "Norton incident" resulted, not from the explosion of a rocket, guided missile, or satellite vehicle, but solely from the fall of a meteorite. Further, the Norton County meteorite, as scientists labeled it, was of an extremely rare and interesting type.

#### *Three Main Groups*

Meteorites, the very occurrence of which was denied even by scientists only a little over a century ago, are now known to be classifiable into three main groups. Scientists label one group the *irons*. These resemble closely fragments of a nickel-iron core such as the earth is believed to possess. Another group is the *iron-stones*, presenting similarities to fragments of the intermediate zone of silicates mixed with nickel-iron, thought to surround the core of the earth. Finally, there are *stony meteorites* or *aerolites*. They resemble in composition and structure fragments of that portion of the outer rocky zone (lithosphere) of the



earth lying beneath the superficial granitic layer.

Long ago, Boisse and Meunier, reflecting on the curious *density spectrum* of the meteorites, ranging from the very dense irons to the lightest aerolites, were led to conjecture that the meteorites might be simply the fragments of a body, in constitution much like the earth, which had been shattered by some catastrophic disruption. Half a century later, in 1901, Farrington of Chicago was independently led by consideration of the *structural characters* of meteorites to theorize that they originated in the disruption of a spheroid of subplanetary dimensions. Quite recently, Harrison Brown of the University of Chicago, was awarded the American Association for the Advancement of Science prize for his remarkable discoveries supporting the "meteorite-planet" theory. At the present moment, this theory of the origin of meteorites is certainly on a firmer basis than any of the many competitive theories.

If we assume that a meteorite-planet once existed, it appears likely, on the basis of the discovery of such achondritic meteorites as those of the Norton County fall, that this planet had, before its disruption, a lithospheric zone like the earth's.

Obviously, the biography of a specimen as rare and significant as the Norton County meteorite is interesting to scientists and laymen alike.

#### *Cause of Disruption Unknown*

Until the disruption of the meteorite-planet, the particular mass that fell in Kansas on February 18, 1948 must have lain quite deeply buried in its lithosphere. Just what caused the disruption of the meteorite-planet, we have no certain means of knowing. It may have been an internally induced explosion, tidal disintegration, or a collision between the meteorite-planet and another planet.

The last of these possibilities now seems to be the most probable. Certainly it offers the most sensational possibilities, but these are not always developed with a weather eye on the hard facts. For example, in April, 1948, a popular weekly of enormous circulation ran a lavishly illustrated account of the newest theory of the origin of the solar system, giving considerable space to an illustration of the collision between the meteorite-planet and another planet, both moving between the orbits of Mars and Jupiter.

Unfortunately, the ghostly wakes trailing behind the colliding planets and the

caption "head-on collision" make only too clear that the planets in question were regarded by the artist as moving in *opposite* directions about the sun—a most distressing error since the newest theory of the origin of the solar system, like all such theories that have gained any measure of acceptance, only gives birth to planets moving in the *same* direction around the sun! Considering the kinetic energies involved in the impact between a meteorite-planet moving in a nearly circular orbit and another planet traveling in the same direction about the sun but following a more eccentric orbit intersecting the first, it is easy to see that a head-on collision of these bodies is not required in order to bring about their fragmentation or even their partial vaporization.

Granting that some sort of collision between planets resulted in the disruption of the meteorite-planet, the Norton County meteorite was "born" sometime within the last billion years or so somewhere in the ring of space enclosed between the orbits of Mars and Jupiter. We can designate the *place* a little more precisely than the *time* of birth because a great multitude of the Kansas meteorite's bigger brothers can actually be observed circulating about the sun between Mars and Jupiter. These are in the region where a curious law, long ago discovered by Bode, predicted that a planet should exist. This "missing planet" of Bode and our hypothetical meteorite-planet are now believed to have been one and the same.

#### *Same Point at Same Time*

How long the Norton County meteorite continued to move in an orbit lying far out beyond that of Mars, we do not know. However, eventually it was thrown, probably by the effect of the giant planet Jupiter, into a less circular orbit. Some portion of this lay within and nearly or actually intersected the orbit of the earth. The orbit may have been traversed by the meteorite countless times, each passage near or through intersection with the earth's orbit representing a potential meteorite fall that failed to materialize simply because the earth-target was not there to be hit. Finally, on the late afternoon of February 18, 1948, the earth and the meteorite arrived at the same point in space at the same time. The latter, rushing at many miles a second down through the terrestrial atmosphere, gave rise to the startling effects described above. All of these phenomena originated in the extremely rapid transformation of the enormous

kinetic energy of the rapidly moving meteorite into other forms of energy, such as radiant-, ionization-, acoustic-, and mechanical energy, as a result of the atmospheric resistance to the motion of the meteorite.

Initially, in the rarified outermost layers of the atmosphere at elevations of 100 miles or more, this resistance was a bombardment of the bare outer surface of the meteorite by individual air molecules. As the meteorite penetrated into the denser layers of the atmosphere, this bombardment rapidly increased in intensity. The heat generated by the countless molecular impacts distilled off enough meteoritic material to generate a mantling atmosphere of vapor about the solid core of the meteorite. This greatly increased the effective size of the target exposed to bombardment by the air molecules.

#### *Effects Became Spectacular*

At about this stage the meteorite first became visible as a bright meteor or shooting star. From this point on, the effects produced by air resistance became more and more spectacular; the meteor blazed out into a fireball so brilliant as to be visible for at least 250 miles. The relatively fragile meteorite exploded several times under the increasing air pressure (one such explosion seems to have occurred at the unusually great height of 37 miles). These explosions resulted in "smoke" clouds and trails that were one of the most widely observed features of the Norton County fall. Finally, the relatively small solid fragments of the meteorite that survived whizzed down to earth accompanied or followed by the bedlam of sounds produced by the swift passage of the meteoritical projectile through the air.

Scientists at anytime would welcome a meteorite as unusual as the Norton County fall. Manned rockets and spaceships seem just around the corner and, with the advent of such vehicles, a premium will be placed on every scrap of knowledge that might be of value to the etheronauts.

Right now fragments of the Norton County meteorite are being studied painstakingly by workers at the Institute of Meteoritics at Albuquerque and by Dr. Harrison Brown at Chicago University's Institute for Nuclear Studies. Their findings, which will be greatly aided by assistance from volunteers who report meteorite finds, will add to the growing pile of knowledge that will be needed before manned rockets can fly out of the earth's atmosphere.