

# KIRIN METEORITES

## Story of a Rare Shower

The widely witnessed Kirin meteorite fall in China last year scattered debris over 500 square kilometers and left the biggest stony meteorite known in the world



Largest piece struck near village, penetrated 6.5 meters, left a pit 2 meters wide.

BY OUYANG TZU-YUAN

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A meteorite shower fell in the Kirin area in northeast China's Kirin province on March 8, 1976. The Kirin fall was unusual in extant world meteorite records in the size of the area over which meteorite fragments were dispersed and in the number and weight of particular pieces. Considerable detail based on accurate observations was provided by workers, peasants and soldiers in the area to the subsequent investigation made by Chinese scientists.

A red fireball, the size of a full moon, appeared suddenly, dozens of kilometers over the northeastern part of the town of Hsinglung, Payen county, in the northeast China province of Heilungkiang, at 15 hours 1 minute and 30-odd seconds, Peking time, on March 8, 1976. The phenomenon was observed by scores of people in the town, and measurements and notes were taken by observers at the town's Red Guard Weather Post. The fireball was seen moving southwestward almost horizontal to the earth at a speed of 10-odd kilometers per second.

Two hundred-thirty kilometers southwest of Hsinglung, Hsing Kuo-chih and five of his colleagues at Tienteh Commune in Kirin province's Shulan county observed the diameter of the fireball to be two and a half to three times that of the moon. They described the fireball as a reddish-white mass rimmed by a bluish-white ring and giving off dazzling rays. They observed its passage through the outer atmosphere for five to six seconds until it disappeared abruptly. Meanwhile, workers, peasants and soldiers by the tens of thousands observed the fiery body over a course from Shulan southwestward to the north of Kirin city. The fiery mass left behind in its path a brilliant trail and whirling clouds of smoke and dust. The breaking up of the mass took place on several occasions during the last few seconds of its flight and many small particles were observed falling.

A violent break up took place when the main body of the fireball was 17 kilometers over the northeastern part of Kirin city. According to peasants in Chinchu Commune on the northern outskirts of the city, the brilliance of the bursting flash rivaled the brilliance of the sun. Sun Kuei-shen, a member of the work team



*Meteorite No. 1, above, weighed 700 kilograms more than the biggest previously known stony meteorite. Left, scientists and workers make preliminary tests on other samples collected.*

Photos: China Features, Peking

sent by the Kirin Municipal Communist Party Committee, and Tai Huan-chang of Chishu Commune in Shulan county both saw a yellow fireball suddenly give off an intense flash as its diameter appeared to expand to a width of two meters. From it a smaller fireball was cast off westward with a pale yellow trail behind. Observers in other localities, however, saw the violent break up give rise to three fireballs of different colors. The large fireball was like the size of a full moon, while the small one seemed the size of a football. The three fireballs moved westward in a procession before they fell one after another.

At that moment, three peasants were traveling and three children playing outside the village of Kaoshan No. 10 Pro-

duction Brigade of Huapichang Commune in Yungchi county west of Kirin city. They were startled by a sound like the shriek of a supersonic plane plus the whining of a flying shell. They saw a huge mass, turning from red to dusky, fall from high above and hit the ground, giving an appalling roar and hurling soil and dust into the air. Clumps of frozen soil landed west of the center, the farthest being 150 meters away. A mushroom cloud rose to a height of 50 meters. The cloud was so dense that everything behind it was obscured from view. The impact shook nearby village houses, broke up cracked window panes and pushed open unbolted doors. A few minutes later, when the pall was dispersed by the wind, the villagers saw a big impact pit on the ground.

The sounds produced by the shock waves during the fireball's rapid passage through the air, the thunderclap of its violent breakup, and a series of rolling, thunderlike echoes altogether lasted four to five minutes and were audible to some one million people over an area 200 kilometers across.

The vibration of the fireball's disintegration made high-tension transmission lines swing, pushed open many doors and windows, shook and toppled goods in shops.

The seismographic observatories at Kirin city and Fengman, registering the shock waves of the violent breakup and taking into consideration the temperature differences in the outer atmosphere which affect sonic wave speed, put the fireball's disintegration at 15:02 hours, Peking time.

This is the human observation over a wide area of the entry of a meteor into the earth's atmosphere and its descent, from the first observation of it to its fragmentations and impact with the ground, a period of less than one minute.

Our joint investigation team for the Kirin incident was made up of scientists from the Chinese Academy of Sciences and from the scientific and technical departments of Kirin province and Kirin city. We arrived in the Kirin area shortly after the fall. In one month we interviewed more than 1,000 workers, peasants and army men who had witnessed the meteorite fall and we held a total of 40 discussions with local people. Measurements and notes were taken, and we made drafts, maps, calculations and tests.

Our investigation acquainted us with the essentials of the fall—the direction and speed of the meteor from space, the angle of entry, the characteristics and the development of the fireball and its sound in the air, and the dispersal pattern of meteorite fragments on the ground.

The meteorite particle referred to earlier, which fell in the village of Kaoshan No. 10 Production Brigade of Huapichang Commune, was the biggest of the Kirin multiple fall and was named Meteorite No. 1. It is also the biggest known stone meteorite in the world, weighing nearly 700 kilograms more than the 1,050-kilogram stone meteorite which fell in 1948 in Norton county, Kansas, in the United States, previously the world's biggest. Meteorite No. 1 hit the ground 65 meters from the nearest house at the eastern end of the village. The geographical coordinate lies at 126°12'52" E and 44°01'31" N.

This meteorite penetrated 6.5 meters into black-clay soil. The vertical axis of the pit was at a 65° inclination with the ground. An upturned rim 0.65 meters high encircled the impact pit produced by the pressure and falling dust as the meteorite smashed through the frozen soil.

The speed of Meteorite No. 1 on impact with the ground is estimated at over 500


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meters per second. From seismic records we concluded that the impact took place at 15 hours 2 minutes and 36±5 seconds, Peking time.

Meteorite No. 1 was shattered as it smashed through the layer of frozen soil. The total weight of the pieces collected in the pit came to 1,770 kilograms. The restored main specimen has a maximum height of 0.8 meters, maximum length of 1.2 meters, maximum width of 1 meter and a circumference of 3.56 meters. The surface is marked by a number of parallel flow lines generated at different times. The pitted surface, flow lines and fractures on the surface show that the original weight of Meteorite No. 1 must have exceeded two metric tons.

The accompanying meteorite shower was scattered over an area covering seven communes with a total population of 100,000 in Yungchi county, Chiaocho county and the northern outskirts of Kirin city.

The shower was distributed in the pattern of an elongated ellipse with the long axis running nearly east to west and extending 72 kilometers. The short axis extended 8.5 kilometers. The area of the ellipse approximates 500 square kilometers, which is the world's largest stone meteorite distribution area, far exceeding the affected area of the Allende fall in 1969 in Mexico, previously the world's largest dispersion.

In tracing the fragments along the long axis of the ellipse, we found that the farther we went westward, the bigger the weight of single fragments. At the westernmost point of the ellipse we located Meteorite No. 1, the biggest. East of it Meteorite No. 2 weighs 400 kilograms, and further east Meteorite No. 3 weighs 123.5 kilograms. The three huge pieces were precisely the fallen bodies of the three fireballs observed by local people when the big fireball disintegrated. As we went further east, the weight of single pieces decreased progressively while the density of distribution increased. The densest distribution was an average of 10 pieces per square kilometer reported by Chiangmifeng Commune.

We collected more than 100 meteorites that had definite landing points. They weigh 2,700 kilograms in all. Because the mass of the meteor was ablated during its passage through the atmosphere, its weight at the moment of break up is estimated at least four metric tons.

The variety of shapes and sizes of Kirin meteorites is great. Their surfaces to the depth of 0.5 to 1 millimeter are invariably covered with fusion crusts. We found evidence of four generations of fusion crust due to the meteor's successive fragmentations in the air.

Many round chondrules are clearly visible. Our study of the chemical and mineral composition and textures shows that the Kirin meteorites are chondrites of the type of high-iron group V. □

**ABSTRACTS**

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