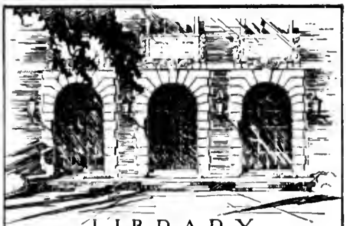

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THE MAPLETON METEORITE

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INTRODUCTION

Soon after Chicago Museum obtained the Mapleton meteorite, it was briefly described (Roy, 1939). In the following month *Rocks and Minerals* (1939) also published an account that was essentially a copy of the Museum article. Later, Mr. Ben Hur Wilson (1944) wrote a popular description of the meteorite. Since Mr. Wilson's report was based largely upon information supplied by the Department of Geology of Chicago Museum, a general account of the meteorite will not be given here. Instead, a digest of the report has been made, containing certain modifications, and pertinent data relating to the physical features and the internal structure of the meteorite have been added.

MAPLETON

Monona County, Iowa, United States of America.
Latitude 42° 10′ 47″ N., Longitude 95° 43′ 18″ W.
Iron, medium octahedrite (OM).
Found June 17, 1939.
Weight 49 kilograms (108 pounds).
Catalogue number Me 2286.

NATURE OF FIND

The meteorite was purchased by the Museum on July 31, 1939, from Mr. Harvey Meevers, of Mapleton, Iowa. It was accidentally found by him on his farm on June 17, 1939, while he was cultivating corn. According to Mr. Meevers, his cultivator caught behind a heavy "stone" that seemed heavier than any other stone he had hitherto encountered. He dug it out of the ground and, believing it to be a mass of iron, carried it to his barn for safe-keeping. The find, like many other finds, would in all probability have been forgotten had it not been for a timely article on meteorites published by F. Barrows Coulton (1939). The article reminded Mr. Meevers of the "mass of iron" he had found a few days earlier. He examined his find and decided that it might be of meteoric origin; so he sent a small sample, approximately 34 grams, to the Museum for examination. It was found to be an iron meteorite and was purchased by the Museum and named "Mapleton," the name of the town close to which it was found.

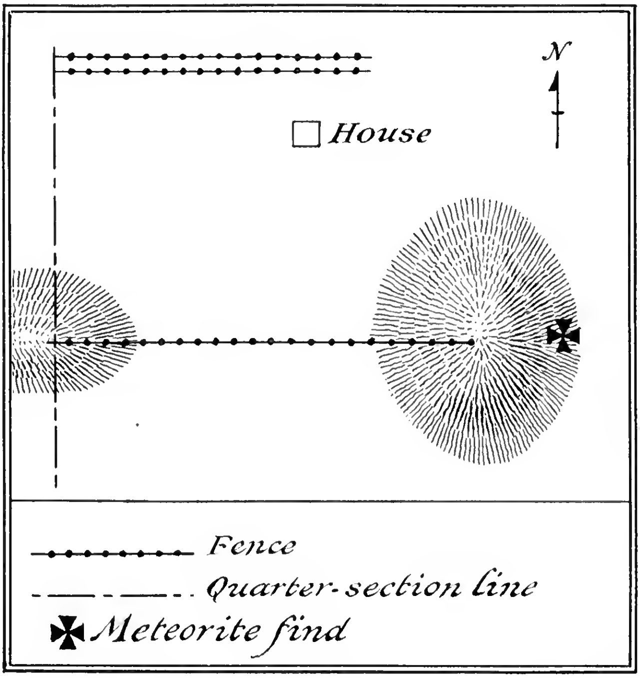

Fig. 35. Diagram showing location where Mapleton meteorite was found.

LOCATION, DATE, AND TIME OF FALL

Previous to the discovery of this iron, four other meteorites were known from the State of Iowa. Three of these were stone and one was iron-stone. The Mapleton is the only iron meteorite thus far reported from Iowa. It was found on the east slope of a rather steep hill (fig. 35) in the northwest quarter of Section 15, Township 85 N., Range 42 W., about three miles east and one mile north of Mapleton, Monona County, Iowa (42° 10′ 47″ N. Lat., 95° 43′ 18″ W. Long.).

The date and time of the fall of the Mapleton are not known. When a meteorite is found, a number of "eye-witnesses" usually

FIG. 36. The Mapleton meteorite. About ×1/5.

crop up with divergent reports, and attempts are made to connect the find with one of these reports. The finding of the Mapleton was no exception. Stories of a "fire-ball" streaking across the sky at such and such an hour, day, and year, poured forth in rapid succession, but none of these stories could be verified, much less associated with the Mapleton. However, it is well to point out here that only the surface of the meteorite had suffered oxidation, as evidenced by the partial alteration and decay of the fusion crust. The iron is otherwise remarkably well preserved, and, because of this excellent state of preservation, it may be assumed that the fall took place in recent decades.

Apparently, the meteorite is only a portion of the original mass, as it appears to have been broken. The disruption must have taken place at a considerable altitude while the meteorite still had high velocity. This can be surmised by the presence on the broken side of elongated furrow-like depressions or pittings that could hardly have been formed under reduced velocity.

SHAPE, SIZE, AND SPECIFIC GRAVITY

The general shape (fig. 36), as preserved, does not conform strictly to any of the characteristic forms of meteorites. Roughly, it has a sub-semicircular outline and resembles a flattened cone that has been cut vertically near the center. One side of it is plano-convex; the other is a very low truncated cone with the apex slightly away from the center. The point of the cone was presumably broken off during disruption of the mass, for instead of having the usual smooth surface it is pitted. The slopes of the cone are unequal and considerably damaged and deformed. The pittings of the plano-convex side, some of which are merged into one another, are larger and more circular, but shallower than those of the opposite side. This is to be expected. The plano-convex side is the rear of the meteorite, and was thus less exposed to the heat and friction of the atmosphere. The conical side (the front of the mass) has many elongated pittings, more or less radially arranged on the slopes and edges of the cone, evidence of the passing of air currents from the apex of the cone during its passage through the atmosphere.

In its present state, the meteorite, which probably does not represent much more than one-half of the original mass, weighs 49 kilograms (108 pounds). Its greatest length, breadth, and height are 17½ inches, 9⅞ inches, and 6¼ inches, respectively. The specific gravity is 7.70, which is average for this class of meteorites.

Since its acquisition, the meteorite has been sawed into five sections, consisting of two end pieces, weighing 35.5 and 47 pounds respectively, and three slabs weighing 4,540, 4,280, and 3,381 grams.

The meteorite has not, as yet, been distributed, with the exception of 20 grams sent in exchange to Dr. H. H. Nininger.

CHEMICAL COMPOSITION

Two chemical analyses were made of the Mapleton:

HENRY HERPERS,[1] *Analyst*

Element	*Percentage*
Fe	92.16
Ni	7.61
Co	0.036
Cu	0.003
C	0.14
S	0.01
P	0.10
Cl	0.00
Total	100.059

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[1] Formerly Assistant Curator of Geology.

ROBERT K. WYANT, *Analyst*

Element	*Percentage*
Fe	92.22
Ni	7.50
Co	0.08
Cu	0.02
C	0.11
S	0.01
P	0.13
Total	100.07

ANALYTICAL METHODS[1]

Only volumetric methods were used for the determination of iron in the Mapleton meteorite, as gravimetric methods often give high results.

As noted by Henderson (1941), much of the poor agreement in meteorite analysis is caused by the incomplete separation of iron and nickel. The nickel content of the Mapleton meteorite was determined by the use of two different methods. Both methods were found to be satisfactory and the results were consistent.

In one procedure, that of Hillebrand and Lundell (1929), tartaric acid is used to prevent precipitation of iron by ammonium hydroxide. Nickel is subsequently precipitated by the use of dimethylglyoxime. In the other method, originally outlined by Henderson (1941), strong ammonium hydroxide is used to separate the nickel from the iron. Four reprecipitations of iron are made. The combined filtrates are evaporated and salts destroyed. Nickel is then precipitated in an ammoniacal solution by the use of dimethylglyoxime.

The remaining elements determined in the analysis of the Mapleton meteorite comprised less than 0.4 per cent of the total and were determined by the usual procedures used in the analysis of iron meteorites.

STRUCTURE

The internal structure of the meteorite was studied both in macro- and micro-etched sections, and in both sections nital (8 per cent nitric acid) was used for etching. The attack of etchant was much faster than is usually the case. Figures appeared almost instantly on application of the etchant and a satisfactory micro-etching was obtained in less than three seconds. The structure, as shown by the figures, is that of a medium octahedrite with a regular

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[1] As used by Robert K. Wyant.

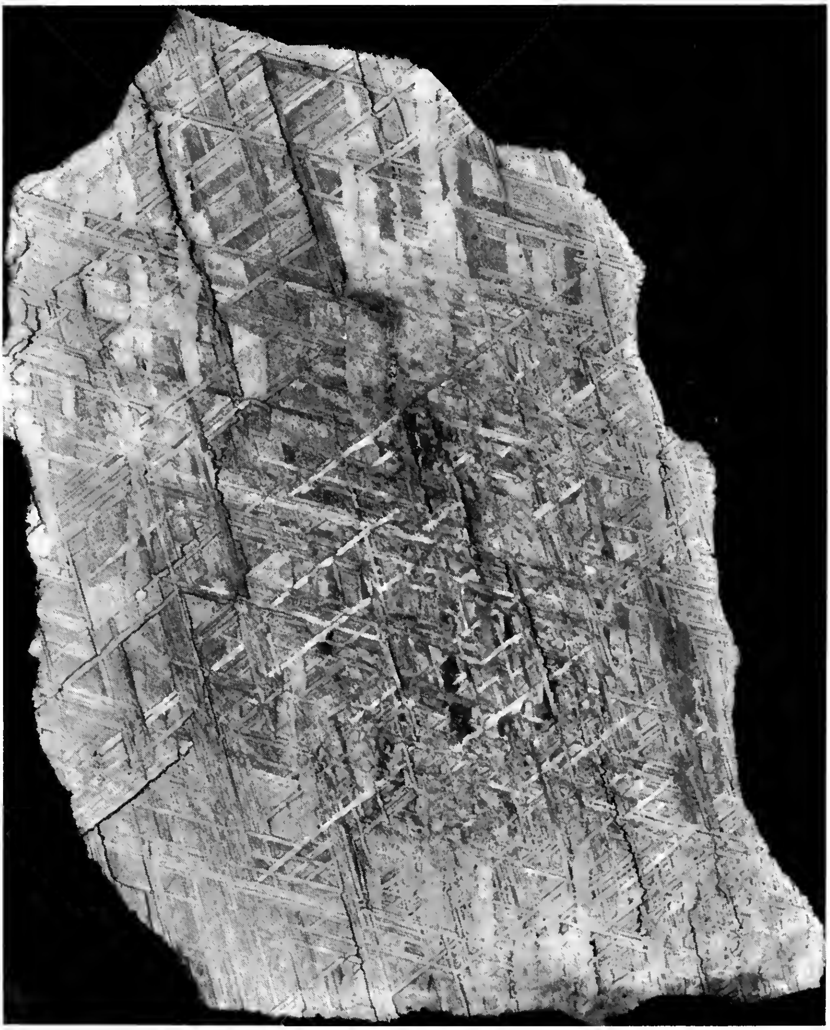

FIG. 37. Slice of Mapleton meteorite, showing well-developed octahedral pattern. About ×½.

pattern (fig. 37). There are many cracks in the section, most of which follow the general octahedral planes. The cracks are narrow and are stained with limonite.

The zone of alteration is clearly visible. Its inner boundary is slightly lighter, and thus serves as a line of demarcation. The depth to which alteration has taken place is shallow and is variable (from a fraction of a millimeter to 3.3 mm.). This indicates, as has been stated above (p. 101), that the mass had disrupted during its flight to the earth and that different surfaces were exposed to heat for varying lengths of time. The meteorite did not suffer prolonged heating, as might be inferred from the shallow depth of the zone of alteration and from the absence of any marked change in its principal components (kamacite, taenite, and plessite fields) in the altered zone.

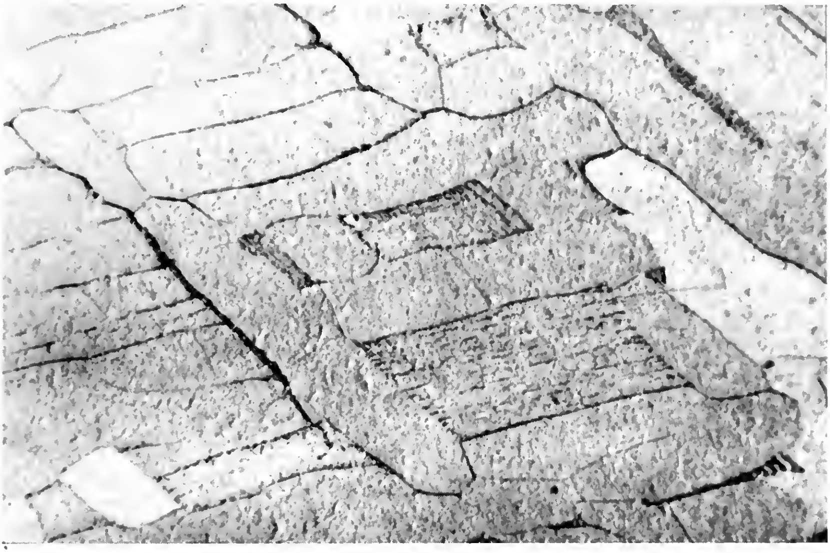

FIG. 38. Typical kamacite bands, showing varying widths. Plessite fields seen here are chiefly rhomboidal. ×10.

The kamacite bands (fig. 38) are fine-grained to granular and vary in width from 0.5 mm. to 1.5 mm. Some are wider and have a swollen appearance, with an average width of 3 mm. These larger bands are not conformable with the octahedral structure (fig. 39), though they are roughly oriented. A few of the larger bands appear to have coalesced into a fascicle. Some of the kamacite bands, in

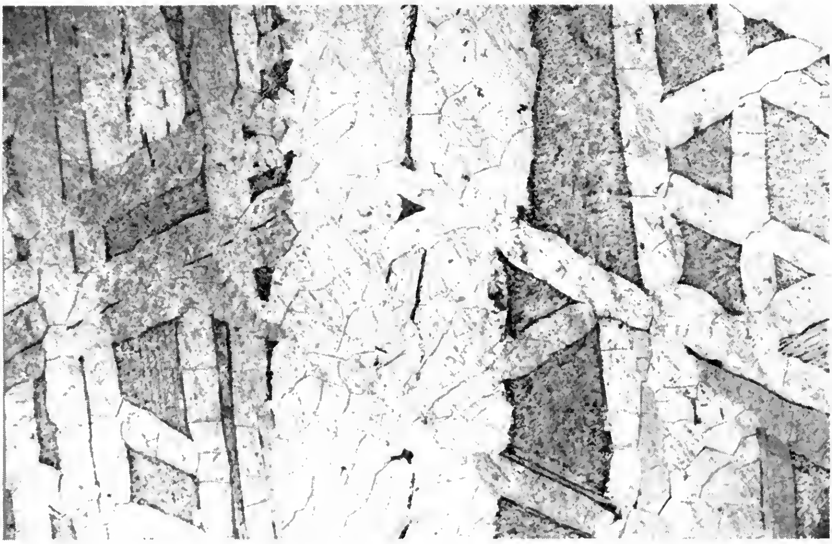

FIG. 39. At the center are two large kamacite bands. They have a swollen appearance and are not conformable with the octahedral pattern. ×6.

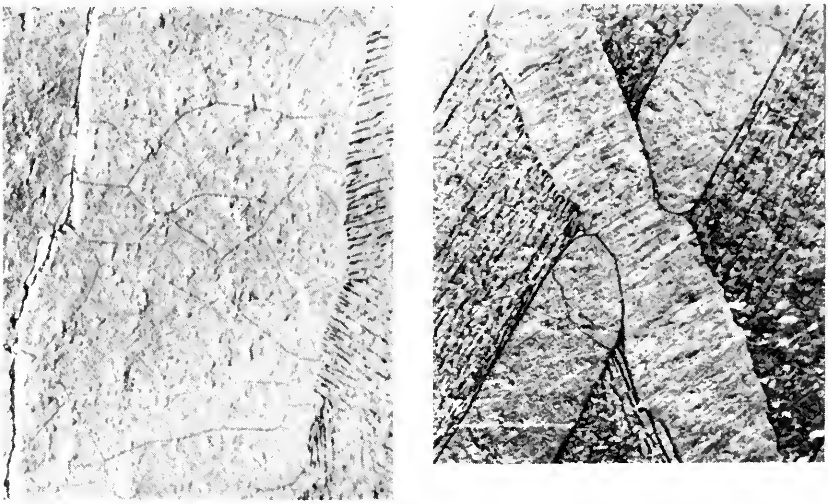

FIG. 40. Left: A kamacite band, showing grain boundaries. Right: Two kamacite bands crossing each other. The angles are occupied by plessite fields. ×13.

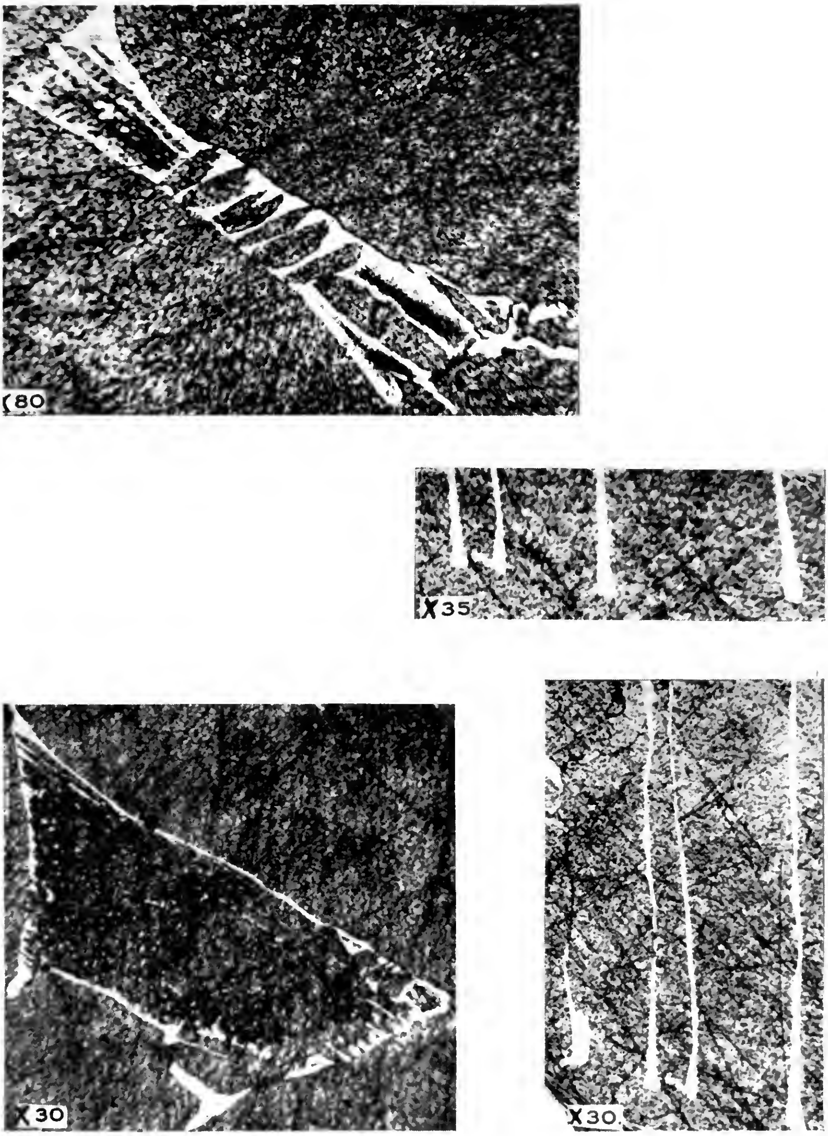

FIG. 41. Taenite lamellae thickened at the ends. Some are looped at the thickened ends and some have darkened cores. Magnifications shown on individual figures.

addition to being fine-grained to granular, have retained traces of taenite particles or lamellae, indicating incomplete separation. Grain boundaries in kamacite bands (fig. 40) are common, more common in one part of the section than in another.

Taenite lamellae bounding the kamacite bands and plessite fields can be distinguished easily by the naked eye. They are not uniform in width and are generally wavy. They occur in various forms, as long or short threads, as needles, and as particles. Some, particularly in plessite fields, appear thickened at the ends, near or at the junction of kamacite bands (fig. 41). Under high magnification, many of these are found to be looped at the thickened ends, some having dark cores, very similar to those observed in Seneca Township, Bethany, and others.

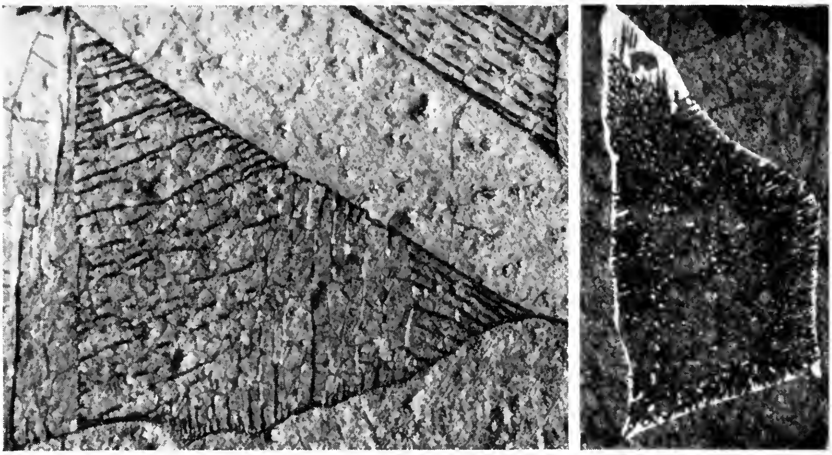

Fig. 42. Enlarged plessite fields. Right: A dense field. ×25. Left: The triangular field with taenite lamellae and kamacite bands running in three directions shows the general octahedral structure. ×14.

Plessite fields consisting of taenite and kamacite are abundant and show an unusual variety of shapes (fig. 42). These fields are both light and dark, the former type predominating. The dark fields, however, are not typical, being not as dark, nor the texture as visibly dense. In some of the fields the kamacite bands bounded by taenite lamellae have three systems, reproducing on a small scale the general octahedral structure. The taenite lamellae in these fields are not always continuous but are often hachured (fig. 43).

Taenite also occurs as particles dispersed in a matrix of granular kamacite in some of the fields. Judging from the relative preponderance of light fields and segregation of clear taenite, it may be assumed that the gamma-alpha phase of separation was fairly complete.

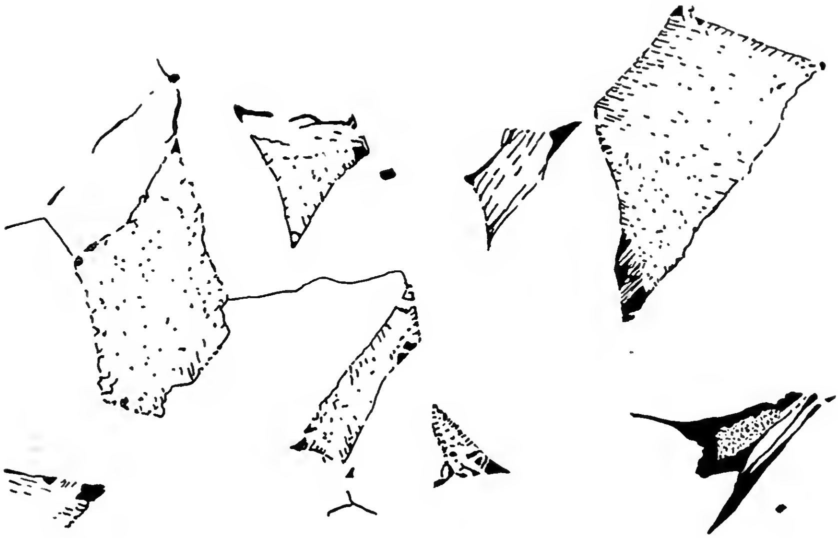

FIG. 43. Plessite fields showing a variety of shapes. ×19. Ink sketches on photographs, using Farmers reducer.

A certain structural feature (fig. 44) resembling Neumann lines has been observed in a limited small area of the section. The lines are straight and parallel, but not equally spaced. Under high magnification they appear grained and show a sheen. They run across kamacite bands but are interrupted by the taenite lamellae bounding the adjoining plessite fields. The lines below the plessite fields are spaced differently from those above. The fact that the lines occur only in one small and limited area makes the interpretation of them as Neumann lines uncertain. They could be transformation figures described and illustrated by Vogel (1927), and more recently discussed and figured by Perry (1944). The figures are thought to have been produced in the gamma-alpha range, the result of coalescence of microscopic alpha needles developing in gamma iron. The lines observed in this meteorite are, however, clear cut and lack the characteristic hatched pattern of transformation figures.

Schreibersite in large forms has not been recognized. The matrix of the section, however, is pitted with numerous, small, grayish-black specks that are depressed and angular. These specks might have been filled originally with schreibersite particles that were pulled out in the process of grinding and polishing the section. A careful examination of the specks over a large area, however, failed to show any trace of phosphide inclusions.

FIG. 44. The lines at the left resemble Neumann lines. They may be transformation figures. ×10.

No other accessory constituents have been observed.

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