SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 107, NUMBER 13

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(WITH FOUR PLATES)

BY
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AND
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U. S. National Museum

(PUBLICATION 3907)

CITY OF WASHINGTON
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(With Four Plates)

The meteorite here described was presented to the United States National Museum by S. H. Perry, who obtained it in 1945 from H. R. Harper, of Beaumont, Ky. It had been plowed up in 1942 on the farm of Samp Johnson, 4 or 5 miles east of Edmonton, Metcalfe County, Ky., and is the twentieth meteorite found in that State.

The mass as received weighed 10,200 grams and was intact except for a small bit that had been removed from one end with a blowtorch, the local heating having left no visible effects on the microstructure of the first slice removed from that end. Its form was elongated and very irregular, the greatest length being about 24 cm.

22.44 lbs

This is obviously an old fall, as nothing remains of the original surface and there is considerable accumulation of brown iron oxide on most of the surface of the mass. Several irregularly shaped depressions occur on the surface of this iron, all of which appear to have been modified by weathering.

*Microstructure.*—Four slices were removed from the end of the mass, and etching revealed it as a finest octahedrite of great regularity and beauty, the width of the bands being very uniform at from 0.5 to 0.8 mm. Like the Carlton, Tex., iron[1] which it resembles, the Edmonton meteorite contains numerous large, irregular, elongated lamellae of kamacite from 1½ to 2 mm. wide and up to 2 cm. long; these are unconformable with the octahedral pattern although roughly oriented in approximately parallel directions.

Although the analysis shows no sulfur and only traces of phosphorus (the sample analyzed being free from inclusions), a few irregular inclusions of troilite surrounded by swathing kamacite may be seen in plate 1, figure 1, as well as a few small schreibersite bodies. In one place a thin zone of schreibersite lies within the swathing kamacite surrounding a troilite inclusion.

The kamacite bands are bordered by tenuous lamellae of taenite.

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[1] Howell, E. E., Amer. Journ. Sci., vol. 40, p. 223, 1890; Proc. Rochester Acad. Sci., vol. 1, pp. 87-89, 1890. In both references the Carlton iron is called Hamilton County.

Though in places the bands are closely grouped, plessite fields are relatively large and very abundant, and are mostly of the "dense" type consisting of imperfectly transformed gamma-alpha aggregate.

A few plessite fields show spheroidized taenite in a ground mass of clear kamacite, a feature that is being observed with increasing frequency as more meteoric irons are studied by metallographic methods. This structure appears to be due to a condition of cooling in which the taenite in the original gamma-alpha mixture was fully transformed but, because of too rapid cooling, could not migrate to the boundaries of the field to form the usual taenite border.

Near the edge of one of the slices there are traces of a zone of heat alteration, containing round bodies of an Fe-$Fe_3P$ eutectic. These bodies, which have been observed in a number of other irons, are apparently due to the melting of schreibersite inclusions within the zone of alteration. Such fused inclusions, having absorbed iron (kamacite) from the surrounding mass, rejected the excess of the iron above the eutectic ratio in cooling, the excess separating as droplets or (as in this case) in the form of dendrites.

*Composition of Edmonton iron.*—A thin slice was cut and etched in order to develop the structures and make more conspicuous any inclusions or structural irregularities. A portion was selected which represented as nearly as possible the average pattern of the meteorite. Care was taken to exclude any visible inclusions from the sample used for the analysis. Meteorites are not homogeneous, and samples selected for analysis should not contain avoidable inclusions.

The chemical analysis reported represents a sample with average widmanstatten structures for this iron, and although the meteorite carries inclusions of troilite and schreibersite, no phosphides or sulfides apparently exist as disseminated small particles in the components which make up the average structure.

The following table shows analyses of the Edmonton, Ky., and the Carlton, Tex., irons. These two individuals have a very similar structural pattern and are also nearly identical in composition.

The specific gravity of the Edmonton iron was determined upon two different portions, both assumed to be free from inclusions. The gravity is only slightly lower than that reported by Eakins for the Carlton iron.

The radium determinations were made by Gordon L. Davis and William D. Urry, of the Geophysical Laboratory in Washington, D. C.

The molecular ratios for iron, nickel, and cobalt are obtained by dividing the percentage of each element found by the atomic weight of the element. The significance of these nickel, cobalt to iron, molec-

TABLE 1.—*Comparison of the Edmonton and Carlton irons*

| | Edmonton, Ky. E. P. Henderson, analyst | Carlton, Tex. L. G. Eakins, analyst |
|---|---|---|
| Fe | 86.61 | 86.54 |
| Ni | 12.57 | 12.77 |
| Co | .79 | .63 |
| P | Trace | .16 |
| S | None | .03 |
| Insol | .009 | .11 |
| Sp. G | 7.908 | 7.95 |
| Sp. G | 7.945 | .... |
| Ratio Fe | 1.550 | 1.550 |
| Ratio Ni | .214 | .218 |
| Ratio Co | .013 | .010 |
| Mol. ratio $\frac{Fe}{Ni + Co}$ | 6.82 | 6.79 |
| Radium | $.046 \pm .001 \times 10^{-12}$ grams per gram | n.d. |

ular ratios is uncertain, but they offer a convenient means of arranging analyses for comparison.

The following table contains all the meteorites now listed in the records of the United States National Museum as from Kentucky. Representative specimens of all these falls are in the Museum's collection.

TABLE 2.—*Kentucky meteorites*

| Name | Type | Weight kg. | County | Latitude N. | Longitude W. |
|---|---|---|---|---|---|
| Bath Furnace | Chondrite | 5.9 | Bath | 38°5′ | 83°45′ |
| Campbellsville | Octahedrite | 15.4 | Taylor | 37°21′ | 85°21′ |
| Casey County | Octahedrite | .73 | Casey | 37°15′ | 85° |
| Clark County | Octahedrite | 11.8 | Clark | ..... | ..... |
| Cumberland Falls | Breccia | 24.1 | Whitley | 36°46′ | 84°15′ |
| Cynthiana | Chondrite | 6 | Harrison | 38°23′ | 84°17′ |
| Eagle Station | Pallasite | 36.5 | Carroll | 38°38′ | 85° |
| Edmonton | Octahedrite | 10.3 | Metcalfe | 37° | 85°35′ |
| Frankfort | Octahedrite | 11 | Franklin | 38°8′ | 84°57′ |
| Glasgow | Octahedrite | 20.3 | Barren | 36°58′ | 85°55′ |
| Kenton County | Octahedrite | 163 | Kenton | 38°50′ | 84°30′ |
| La Grange | Octahedrite | 51 | Oldham | 38°25′ | 85°30′ |
| Marshall County | Octahedrite | 6.8 | Marshall | 36°50′ | 88°20′ |
| Mount Vernon | Pallasite | 159.2 | Christian | 36°55′ | 87°25′ |
| Nelson County | Octahedrite | 73 | Nelson | 37°50′ | 85°25′ |
| Providence | Octahedrite | 6.8 | Trimble | 38°34′ | 85°12′ |
| Salt River | Octahedrite | 3.7 | Bullitt | 37°58′ | 85°38′ |
| Scottsville | Hexahedrite | 10 | Allen | 36°43′ | 86°6′ |
| Smithland | Ataxite | 5 | Livingston | 37°10′ | 88°28′ |
| Williamstown | Octahedrite | 31 | Grant | 38°38′ | 84°31′ |

## EXPLANATION OF PLATES

### PLATE 1

FIG. 1. Slice, macro etch, × ⅘.

FIG. 2. Portions of two kamacite bands, one horizontal, two vertical with plessite in a variety of forms. The fields at left and upper right show a dense gamma-alpha aggregate surrounded by borders of clear fully transformed taenite. The narrow field or lamella in the center, separating the vertical bands, is mostly clear taenite. In its upper portion the structure is in part lamellar; three dark areas show oriented needles (lamellae) of the gamma-alpha mixture. A rounded area of kamacite is enclosed near the top, and lower an oval of kamacite with Neumann lines. In the center of the right-hand kamacite band is a lamella of taenite gray or black by reason of supersaturation with respect to kamacite. Picral 30 seconds, × 60.

### PLATE 2

FIG. 1. Core of imperfectly transformed gamma-alpha aggregate in the center of a triangular taenite body. The acicular structure shows some orientation. Picral 15 seconds, × 400.

FIG. 2. Edge of a plessite field. The taenite along the interface shows no grayness, but is perfectly transformed. The specks and particles in the kamacite (above) are probably taenite, showing black because of the strong attack of the etchant along their interface. Picral 15 seconds, × 400.

### PLATE 3

FIG. 1. A taenite lamella, with core of dark, acicular gamma-alpha aggregate oriented in conformity with the general octahedral pattern. Picral 15 seconds, × 400.

FIG. 2. Part of a plessite field. At upper right, a confused structure of gray supersaturated taenite in a dark gamma-alpha aggregate, and kamacite in lamellae and irregular particles. At lower left, imperfectly spheroidized taenite. Between the two areas there has been some invasion of hydroxide. Picral 15 seconds, × 400.

### PLATE 4

FIG. 1. Part of the upper right portion of plate 3, fig. 2. The nature of the structure is more evident. Picral 15 seconds, × 400.

FIG. 2. An area in a zone of alteration. From upper left to lower right; dense core of a plessite field; clear taenite border of a plessite field; kamacite; edge of slice. The kamacite shows a secondary granulation caused by superficial heating in flight through the air, which also probably homogenized the gamma-alpha aggregate in the plessite field. In the kamacite area three original schreibersite inclusions have been altered into an Fe-$Fe_3P$ eutectic. These eutectic areas show clear borders of phosphide, the excess of dissolved iron (kamacite) having been able to migrate to the surrounding mass instead of being entrapped to form dendrites. Picral 15 seconds, × 400.

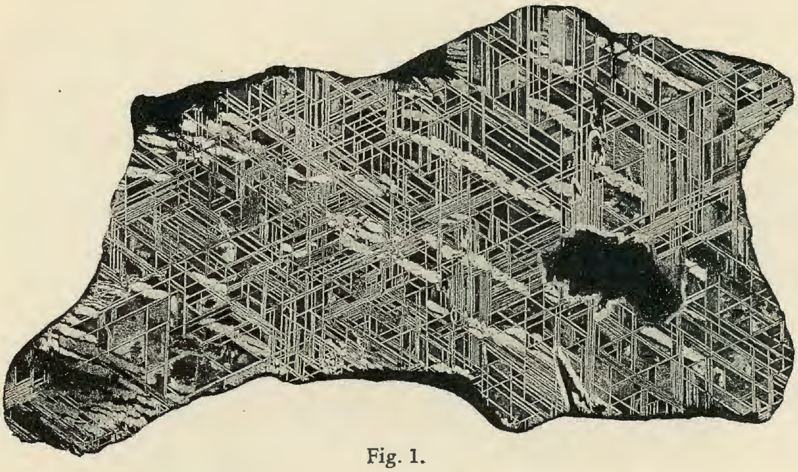

Fig. 1.

Fig. 2.
(See explanation of plates.)

THE EDMONTON, KENTUCKY, METEORITE

Fig. 1.

Fig. 2.
(See explanation of plates.)

THE EDMONTON, KENTUCKY, METEORITE

Fig. 1.

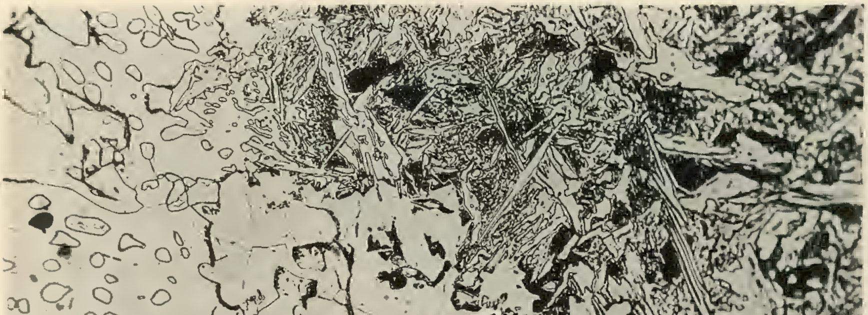

Fig. 2.
(See explanation of plates.)

THE EDMONTON, KENTUCKY, METEORITE

Fig. 1.

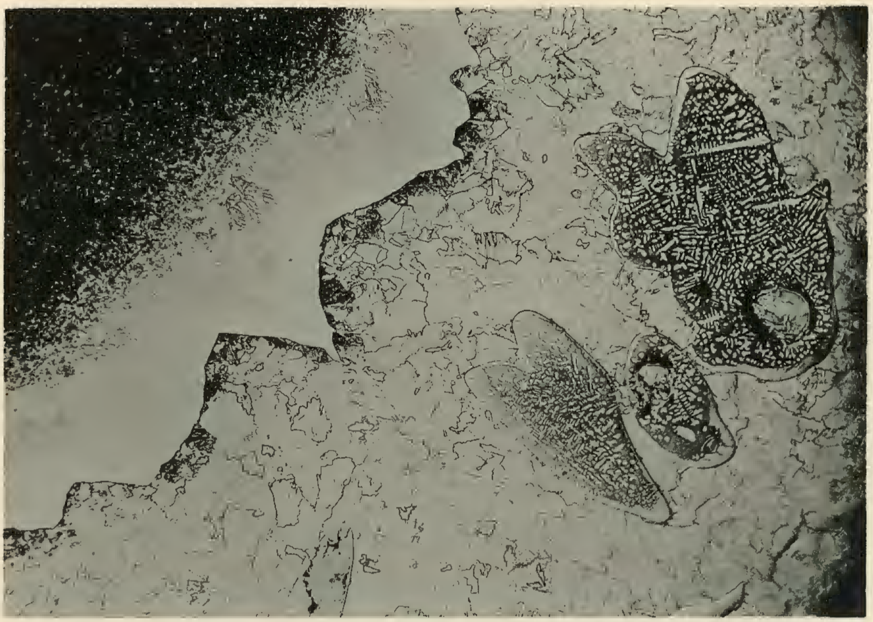

Fig. 2.
(See explanation of plates.)

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