On a Meteoric Iron (containing Crystallised Chromite) found about the year 1880 in Greenbrier County, West Virginia, U.S.A.

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A SINGLE fragment of iron, having an estimated weight of eleven pounds, was found about the year 1880 on or near the top of Alleghany Mountain, 3 miles north of White Sulphur Springs, Greenbrier County, not far from the eastern border of West Virginia, U.S.A.; this corresponds to longitude 80° 20′ W. of Greenwich, latitude 37° 51′ N. The finder and his official agent, thinking it a piece of rich iron ore, searched unsuccessfully for a vein: the specimen itself was taken to a country smith's shop, heated and cut with a cold chisel; the pieces were distributed as specimens of iron ore. Some time afterwards, two of them, weighing respectively 63 oz. and 31 oz., were given by the agent to Mr. Matthew A. Miller, Civil Engineer, of Richmond, Virginia; convinced of their meteoric origin, he immediately tried to recover the pieces already distributed, but after travelling several hundred miles was forced to the conclusion that they were irrecoverably lost. From Mr. Miller the two pieces were acquired for the British Museum.

In shape they are irregular: each of them presents clear evidence of being fragmentary, the surface being partly smooth and pitted, and partly jagged, the latter showing in a remarkably distinct way edges, faces, and crevices which belong to an octahedral structure.

Relative to water at 4°, and allowing for displaced air, the specific gravity at 17°·2 C. of a thin slice, free from rust and weighing 11·0552 grams., was found to be 7·869 (uncorrected 7·89).

Relative to a solution of copper sulphate, a polished surface of the iron is immediately active.

The iron is extremely soft, and was easily sawn into slices.

On the polished faces of these no stony minerals are visible, but there are seen sections of a few rounded cavities, of which the contents have a greyish-black colour and a metallic lustre; this material is principally finely divided iron which has perhaps been worked into the cavities during the sawing of the specimen, and the subsequent levelling of the surface; the rest is graphitic carbon, which may have been sufficient to fill the cavities when the specimen was intact. No chromite was found in the cavities.

During the polishing of one of the sections a part of its surface was bent inwards, and there was found to be an empty cavity with plane faces: the quadrilateral lid of the cavity is 6 mm. long and 3 mm. wide: three of the edges of the section of the cavity were seen to be parallel to structural lines visible on the polished surface even before etching: the sides of the cavity were rusty. Similar cavities are shown by the iron from Rancho de la Pila, Durango, Mexico.

After treatment with bromine-water a polished face shows very distinct Widmanstätten figures. On a section not very much inclined to an octahedral face the beams of kamacite have a thickness varying from 0·8 to 1·2 mm.; they have straight edges, are in groups, and are sometimes uninterrupted for a length of 17 mm. They are separated by very thin layers of lustrous tänite. The remaining component, the plessite, is plentiful, but is very homogeneous in structure, and not very different in appearance from the kamacite. There is no orientated sheen, such as is presented by the etched surfaces of many meteoric irons. The figures approximate to those on one of the slabs of an iron from Staunton, Virginia, U.S.A., now shown in the British Museum: to this also it is very similar in its percentage composition, as pointed out later.

A fragment of the iron, presenting no visible enclosures, and weighing 1·6 grams., yielded a trace of sulphuretted hydrogen when warmed with dilute hydrochloric acid. Iron, nickel, cobalt and copper were found in the solution. The small black insoluble residue was evidently composite, for part of it was only slightly more dense than the solution, and remained for a time in a state of suspension, while the rest, after disturbance, quickly settled to the bottom of the flask. The former material was doubtless graphitic carbon; the latter, when washed and dried, was seen to consist of (1) a fine powder, (2) small fragments, (3) a thin elongated plate, and (4) a single opaque black crystal with bright faces and a metallic lustre.

The crystal was found to be very fragile, for it broke when pushed gently with a platinum wire. Some of the fragments of the crystal were faintly attracted by a bar magnet. The largest fragment was measured on the reflective goniometer, and found to present five of the faces of a regular octahedron: in addition, there are two narrow faces which give images; one of them is a face of the dodecahedron, and the other corresponds in position to a face of the form {221}: the angle (111·221) was measured to be 15°39′, the calculated angle being 15°48′. This fragment is a little more than a millimeter in diameter. Another fragment of the crystal was found to be insoluble in aqua regia, and imparted

a beautiful green colour to a bead of microcosmic salt. Another fragment was found to be incombustible and infusible. Hence we may infer that the crystal is doubtless chromite.

Microscopic crystals of this mineral occur in the meteoric stones, and minute crystals were found by Maskelyne[1] in the siderolite of Breitenbach; in the meteoric irons, however, the existence of crystallised chromite has up to the present not been completely established. The only instance appears to be one recorded by Shepard:[2] in the insoluble residue of the iron of Seneca River, Shepard found two octahedral crystals, weighing together $\frac{1}{200}$th of a grain, and presenting the octahedral form and the lustre of chromite: in the absence of further crystals no examination for chromium was made.

The fragility of this crystal of chromite is of some interest, as showing clearly that easy frangibility of a crystallised material, generally difficult to break, is in itself no proof of pseudomorphism: it will be remembered that the crystals of graphitic carbon obtained from the Youndegin iron possessed this character. Maskelyne has likewise directed attention to the fact that some of the rounded crystals of asmanite enclosed in the siderolite of Breitenbach are extraordinarily brittle on their surfaces, and often fly into fragments even with the most careful handling.

The fine powder, small fragments, and the thin elongated plate, were likewise found to be essentially chromite.

Phosphorus was found in the insoluble residue, and was present probably as phosphide of iron and nickel.

For the quantitative analysis 5·0789 grams. of the filings obtained from a large section of the iron were dissolved in aqua regia, and the following percentage composition was obtained by methods detailed in a previous paper:[3]—

	Greenbrier Co.	*Trenton.* (L. Smith.)	*Rio Juncal.* (Damour.)	*Seneca River.* (Shepard.)	*Staunton.* (Santos.)
Iron	91·59	91·03	92·03	92·12	91·44
Nickel	7·11	7·20	7·00	7·54	7·56
Cobalt	0·60	0·53	0·62		0·61
Copper	trace	trace			0·02
Phosphorus ...	0·08	0·14	0·21	0·08	0·07
Sulphur	trace				0·02
Residue	0·12	0·45		0·26	0·14
	99·50	99·35	99·86	100·00	99·86

[1] *Philosophical Transactions*, 1871, Vol. CLXI. p. 359.
[2] Amer. Jour. Sc. 1853, Ser. 2, Vol. XV. p. 365.
[3] *Mineralogical Magazine*, 1887, Vol. VII. p. 124.

In another experiment made to determine the copper and sulphur, 9·4364 grams. of the filings were treated with dilute hydrochloric acid, and the evolved gas was passed through bromine-water to which some hydrochloric acid had been added: the sulphur was found to be only 0·007 per cent. and the copper 0·01.

The above percentage composition is approximately that of the Trenton,[1] Rio Juncal,[2] Seneca River, and Staunton[3] irons, as shown in the adjacent columns.

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[1] *Amer. Journ. Sc.*, 1869, Ser. II. Vol. XLVII. p. 271.
[2] *Comptes Rendus*, 1868, Vol. LXVI. p. 569.
[3] *Amer. Journ. Sc.* 1878, Ser. III. Vol. XV. p. 337.