THE MINERALOGICAL MAGAZINE

AND

JOURNAL

OF THE

MINERALOGICAL SOCIETY.

No. 35. DECEMBER 1887. Vol. VII.

On a Meteoric Iron seen to fall in the District of Nejed, Central Arabia, in the year 1863.

By L. Fletcher, M.A., F.C.S., President; Keeper of Minerals, British Museum; late Fellow of University College, Oxford.

[Read May 10th, 1887.]

In 1885 a trustworthy Persian agent, through whom various antique objects had been already acquired for the British Museum, offered for sale to its authorities a so-called thunderbolt, weighing 131 lbs. (59·4 kilograms), and submitted at the same time the following translation of a Persian letter from his Excellency Hajee Ahmed Khane Sarteep, Ex-Governor-General of Bunder Abbas, Persian Gulf, and Grand Vizier of Muscat:—

"Bushire, dated 14th Di Koodah, 1301.

"Received on the 7th October, 1884.

"In the year 1282 after the death of Mahomed, when Mame Faisale Ben Saoode was Governor and General-Commander-in-Chief of the Pilgrims, residing in a valley called Yakki, which is situated in Nagede, in Central Arabia, Schiekh Kalaph Ben Essah, who then resided in the above-named valley, came to Bushire, Persian Gulf, and brought a large thunderbolt with him for me, and gave me the undermentioned particulars concerning it.

"'In the spring of the year 1280, in the valley called Wadee Banee Khaled, in Nagede, Central Arabia, there occurred a great storm, thunder and lightning being particularly prevalent; and during the storm an enormous thunderbolt fell from the heavens, accompanied by a dazzling light, similar to a large shooting star, and it embedded itself deeply into the earth. During its fall the noise of its descent was terrific. I, Schiekh Kalaph Ben Essah, procured possession of it, and brought it to you, it being the largest that ever fell in the district of Nagede. These thunderbolts, as a rule, only weigh two or three pounds, and fall from time to time during tropical storms.'

"The above concludes the narrative of Schiekh Kalaph Ben Essah.

"I myself saw in Africa four years after the above date a similar one, weighing 133 pounds, to that which Schiekh Kalaph Ben Essah brought to me, and the Sultan of Zanzibar, Sayde Mayede, obtained possession of it and forwarded it to Europe for the purpose of having it converted into weapons. For this reason I have forwarded my thunderbolt to London (as when melted and made into weapons they were of the most superior kind and temper), considering it one of the wonders of the world, and may be a benefit to science.

"The said Schiekh Kalaph Ben Essah, who brought me this thunderbolt, is still alive, and under Turkish Government control at Hoodydah, near Jeddah.

"Yours truly,

"(Signed) HAJEE AHMED KHANE SARTEEP."

As the mass presents characters identical with those of undoubted meteoric irons, the genuineness of the account given in the above letter is almost beyond criticism: the *naive* remark that Nejed thunderbolts as a rule only weigh 2 or 3 lbs. should convince the most sceptical that intentional deceit is here out of the question.

The mass is thus one of the small group of meteoric irons, numbering at most nine or ten, of which the fall has been actually observed; and of these it is the largest.

The first day of the year 1280 of the Mahommedan Calendar corresponds to June 18th, 1863, of our reckoning.

The mass is rudely tetrahedral in shape: its length is 16 inches (41 cm.), and the breadth and thickness are both about 11 inches (28 cm.). The surface is completely covered with pittings, similar to those of the Braunau and Johnson County irons; such pittings are often shown by the meteoric stones. There is no evidence of weathering, and on the greater part of

the surface the thin black crust of magnetic oxide of iron formed during the passage through the air is visible.

Relative to water at 4°, and allowing for displaced air, the specific gravity at 23° C. of a thin slice weighing 6·0859 grams was determined to be 7·863 (uncorrected 7·89).

Relative to a solution of copper sulphate, the iron is active, the reducing action having visible results after two minutes from the beginning of contact.

The iron is soft, and is easily cut with a hack-saw. During the preparation of some thin slices, small enclosures both of graphitic carbon and of troilite were met with, and present the usual characters: no stony matter was apparent.

On the large polished face, in addition to some smaller enclosures of troilite, there is one having a breadth of 3 mm. and a length of 9 mm.: several cracks starting from it are filled with the same material.

When etched with bromine-water the polished surface displays excellently the Widmanstätten figures: the beams of kamacite are straight and long, and are sometimes uninterrupted for a distance of three or four centimeters: on a section so taken that the beams form approximately equilateral triangles, their thickness averages about 0·8 millimeters. In the groups of parallel beams of grey kamacite extremely thin layers of intervening bright tänite are visible. The remaining plessite, which is very similar to the kamacite in its appearance, shows the fine parallel ridges ("combs") mentioned by Reichenbach. Large patches of the etched face have an orientated sheen. The etched section is very similar to that of Verkhne Udinsk: the figures are as well-defined as those of Toluca, but the beams of kamacite are longer, more even in thickness, and form larger groups, while the plessite is less striking.

When treated with warm dilute hydrochloric acid a fragment of the iron containing no visible enclosures yielded a black insoluble residue consisting chiefly of amorphous graphitic carbon: the last parts to dissolve were small thin bright metallic plates, of which some at least were enclosed by the carbon. Iron, nickel, cobalt, and copper were the only metals found in the solution: from an as yet unfinished examination of a photograph of the spectrum of the electric arc between poles of this iron, Professor Lockyer infers the presence of traces of titanium, aluminium, manganese, barium and calcium.

On analysis of the filings obtained during the levelling of the large

section, the following numbers were obtained by the methods already described,[1] and give as the average composition of the mass :—

	Nejed.	*Trenton.*	*Toluca.*	*V. Udinsk.*
Iron	91·04	91·03	90·74	91·05
Nickel ...	7·40	7·20	7·78	8·52
Cobalt ...	0·66	0·53	0·72	
Copper ...	trace	trace	0·03	—
Phosphorus ...	0·10	0·14	0·24	trace
Sulphur ...	trace	—	0·03	trace
Insol. Residue	0·59	0·45	0·34	0·58
	99·79	99·35	99·88	100·15

The black residue insoluble in *aqua regia* consists chiefly of amorphous carbon ; when heated on platinum foil it begins to smoke, and afterwards takes fire, burning with a luminous flame : it contains a trace of chromite, which gives a green colour to a bead of microcosmic salt.

In chemical composition the Nejed iron is very similar to Trenton, as determined by Lawrence Smith,[2] to one of the masses from the Toluca Valley, as determined by Pugh,[3] and also to Verkhne Udinsk, as determined by Kotschubei.[4]

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[1] *Min. Mag.* 1887, Vol. VII. p. 124.

[2] *Amer. Jour. Sc.* 1869, Series 2, Vol. XLVII. p. 271.

[3] *Annal. der Chem. und Pharm* , 1856, Vol. XCVII. p. 385.

[4] *Zeitsch. d. deutsch. geol. Gesell.*, 1864, Vol. XVI. p. 356.

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

By L. Fletcher, M.A., F.C.S., President; Keeper of Minerals, British Museum; late Fellow of University College, Oxford.

[Read October 25th, 1887.]

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.