The meteoric iron of Karee Kloof, and the meteoric stones of Leeuwfontein and Sinai Peninsula.

(*With Plate III.*)

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Meteoric Iron of Karee Kloof, Cape Province, South Africa.

THROUGH the kindness of Mr. F. W. FitzSimons, Director of the Port Elizabeth Museum, South Africa, pieces of this iron were placed at the disposal of the writer for examination and analysis. The original mass, weighing about 203 lb. (92 kg.), was found at Karee Kloof, about nine miles from Hofmeyer, Cape Province, South Africa, and was presented to the Port Elizabeth Museum by Mr. N. H. Ogilvie in 1914.[1] From a cast which was made under the direction of Miss M. Wilman, Director of the McGregor Memorial Museum, Kimberley, the dimensions of the mass are approximately $43 \times 30 \times 20$ cm. It is very irregularly shaped, is pitted with 'thumb-marks', and is cavernous with depressions, one of which on the side shown in Pl. III, fig. 1, has dimensions of about $20 \times 15 \times 7\frac{1}{2}$ cm. According to Miss Wilman, the colour is mostly haematite-red with brown rusted patches, but it appears to have been not very much oxidized, since on the edges the white metal shows through. That the fall was not very recent, however, is indicated by a fragment from the surface of the iron which along cracks shows a white deposit, proved by optical and chemical examination to consist of concretionary calcite. The specific gravity ($D\ ^{14}_{4}$) of the iron, as determined by hydrostatic weighing on 27 grams, is 7·56.

Etching of a polished surface of the iron shows that it is a *coarse octahedrite* with kamacite bands mostly from $1\frac{1}{2}$ to 2 mm. broad. Taenite is conspicuous, separating the kamacite bands, but plessite is

[1] Director's Report for 1914, Port Elizabeth Museum, 1915, p. 4, fig.

almost absent. In parts the kamacite bands have fairly straight edges, but mostly they are of rounded and irregular outline and occasionally as much as 4 or 5 mm. broad without any interruption of taenite. Schreibersite is seen on the polished face, both as large plates up to 2 cm. in length and 1½ mm. in width, and also as minute strings closely associated with the taenite and sometimes encircling grains of kamacite. Examination of a polished face under the microscope, by reflected light as obtained by the use of a Watson-Conrady illuminator, revealed structures very similar to those described and figured by H. V. Ellsworth in the Annaheim meteorite.[1] As in that meteorite, schreibersite and taenite both contribute to mark the boundary between areas of kamacite.

Chemical composition.—A quantitative analysis was made on 7·1148 grams of the British Museum specimen (Reg. No. 1920,431). The nickel was determined as metal, after separation from iron by means of sodium acetate; and the determination was checked by one made with dimethylglyoxime.

The result of the analysis is as follows:

Fe	90·79
Ni	8·27
Co	0·68
Cu	0·03
P	0·24
S	trace
Insoluble	0·03
	100·04

The residue insoluble in acids consisted mainly of the usual minute chips having the optical characters of quartz, but besides these were some of orthorhombic pyroxene, slightly yellow in colour with high refraction and double refraction, and some of felspar having refraction slightly less than that of nitrobenzol (1·55) and showing in one case twin-striations with a low angle of extinction: a few black grains, probably of chromite, were also present.

The Karee Kloof meteoric iron is a *coarse octahedrite* having a percentage of nickel of about 8¼ and a ratio of iron to nickel of about 11.

[1] R. A. A. Johnston and H. V. Ellsworth, Trans. R. Soc. Canada, 1921, ser. 3, vol. 15, sect. 4, pp. 69–92, 14 pls., 3 text-figs. [Min. Abstr., vol. 1, p. 406.]

Meteoric Stone of Leeuwfontein, Transvaal.

This meteoric stone was kindly placed at the disposal of the writer for examination by Dr. A. W. Rogers, Director of the Geological Survey of the Union of South Africa, and a piece (Reg. No. 1922,769) weighing 144 grams was obtained for the British Museum Collection. It was seen to fall on June 21, 1912, at about 2 p m. at Leeuwfontein, Engelbrecht Drift, Pretoria, Transvaal. Mr. Martinuus Swart, the owner of the farm on which the meteorite fell, stated, in reply to inquiries made by

Fig. 1.—The Meteoric Stone of Leeuwfontein, Transvaal. (Actual Size.)

Dr. E. C. Van Hoepen, that he was busy with irrigation in his corn lands when there was 'thunder and lightning in the air and a noise', and he saw the stone fall about thirteen paces from him in the presence of Mr. F. J. Halscher and two natives. The stone when picked up was lukewarm.

The stone, which weighed originally 460 grams (about 1 lb.), is roughly coffin-shaped, with one end more pointed than the other. The lower surface (text-fig. 1) is slightly concave and shows indistinct signs of flow of material, the upper three surfaces, from the edges of which the crust has been worn away, are smooth and convex, and the three side faces are not quite so smooth and show small 'thumb-marks'. A cut surface is

pale-grey (intermediate) in colour, and shows grains of iron not very thickly distributed but one or two as much as 3 mm. across, and chondrules not very plentiful but one 4 mm. in diameter. Under the microscope in thin section the stone is seen to be fairly crystalline with few chondrules, and these ill-defined and passing imperceptibly into the matrix: the clear, colourless, interstitial material is for the most part isotropic (maskelynite). The fragmentary chondrules are mainly of the barred pyroxene variety, but some vestiges of the porphyritic olivine type were seen. The specific gravity ($D\ ^{14}_{4}$) of the stone, as determined by hydrostatic weighing on 135·33 grams, is 3·46.

Chemical Composition.—A chemical analysis was made by the method described in a previous paper[1] in order to determine the amount and composition of the nickeliferous iron. About 7½ grams of the British Museum specimen (Reg. No. 1922,769) were powdered and separated into attracted and unattracted portions.

Weight of attracted material	=	0·8950	grams.
,, unattracted ,,	=	6·5999	,,

The result of the analysis of the attracted material is as follows:

Insoluble silicate	8·94
Soluble silicate	6·54
Troilite	1·81
Ni	10·72
Fe(+Co) by diff.	[71·99]
	100·00

The Leeuwfontein meteoric stone is an *intermediate hypersthene-chondrite* containing 10·09 per cent. of nickeliferous iron in which the ratio of iron to nickel is about 7.

Meteoric Stone of Sinai Peninsula, Egypt.

Fall of the stone.—According to the accounts of the fall of this stone which have been already published[2] and the information kindly given to the writer by Mr. T. A. Coward of Manchester University, the stone fell with a loud whizzing noise at about 2·30 p.m. in July (probably between 14 and 17), 1916, on the slope of contour 70, about eight miles east of

[1] Min. Mag., 1919, vol. 18, p. 349.

[2] H. Wilde, Mem. Manchester Lit. Phil. Soc., 1917, vol. 61, no. 4, pp. 1–2. [Min. Abstr., vol. 1, p. 405.]

Kantarah on the desert route to Katia, not far from Port Said, on the northern coast of the Sinai Peninsula. The fall was witnessed by Captain Cyril Norbury and other officers of the 7th Manchester Regiment then engaged in military operations in Egypt during the Great War. He states that the stone was found three minutes after it fell, buried about a foot in fine, loose sand, and was warm to the hand when dug up. At the same time another stone was reported to have fallen about fourteen miles away on the other bank of the Suez Canal, for the 6th Manchesters who were quartered there heard a similar buzzing through the air, but no stone appears to have been found. The Kantarah stone was brought to England by Captain Norbury and was given to Dr. Henry Wilde, by whom it was presented to the Manchester Museum. Through the kindness of Sir Henry Miers and Mr. T. A. Coward, it was placed at the disposal of the writer for examination, and a piece (Reg. No. 1923,1) weighing 116 grams was obtained for the British Museum Collection.

Physical Characters.—The stone, which originally weighed 1455 grams and measured roughly 12 × 9 × 6 cm., is covered with the usual dull black crust, but only partially on the smaller of two irregular depressions (apparently rough surfaces of most recent fracture) on opposite sides of the stone. A striking feature of the stone is the prow-like end (Pl. III, fig. 2) where three fairly plane faces meet. This was probably the forward end during the flight of the stone, although lines of flow of the fused crust are not very apparent except on the straight edge of the depression above the prow where there is a slight thickening of the crust. The crust generally is about $\frac{1}{2}$ to $\frac{3}{4}$ mm. thick. A cut surface of the stone is light-grey (intermediate) in colour, and shows fairly plentiful grains of nickeliferous iron, and troilite in less amount; the grains of metal are mostly less than 1 mm. in greatest dimension, but one is as much as 4 mm. square. Under the microscope in thin section, chondrules are seen to be not very plentiful, and are generally ill-defined and fragmentary except in the case of a few dark and fairly spherical ones. They are mostly of banded or radiating proxene, but some of idiomorphic olivines nearly absorbed also occur. Interstitial material is mainly isotropic (maskelynite), but a little dusty merrillite and clear felspar also occur. The specific gravity ($D\ ^{14}_{4}$) of the stone, as determined by hydrostatic weighing on 99·39 grams, is 3·47.

Chemical Composition.—A chemical analysis was made, as in the case of the previous stone, in order to determine the amount and composition of the nickeliferous iron. About 9 grams of the British Museum

specimen (Reg. No. 1923,1) were powdered and separated by the magnet into attracted and unattracted portions.

Weight of attracted material	=	0·8727 grams.
„ unattracted „	=	8·2058 „

The result of the analysis of the attracted material is as follows:

Insoluble silicate	6·29
Soluble silicate	4·29
Troilite	trace
Ni	13·52
Fe(+Co) by diff.	[75·90]
	100·00

The Sinai Peninsula (Kantarah) meteoric stone is an *intermediate hypersthene-chondrite* containing 8·60 per cent. of nickeliferous iron in which the ratio of iron to nickel is about $5\frac{1}{2}$.

EXPLANATION OF PLATE III.

FIG. 1.—Photograph of cast of the Karee Kloof meteoric iron. About a quarter actual size.

FIG. 2.—Photograph of Sinai Peninsula meteoric stone, showing prow-like end. Actual size.

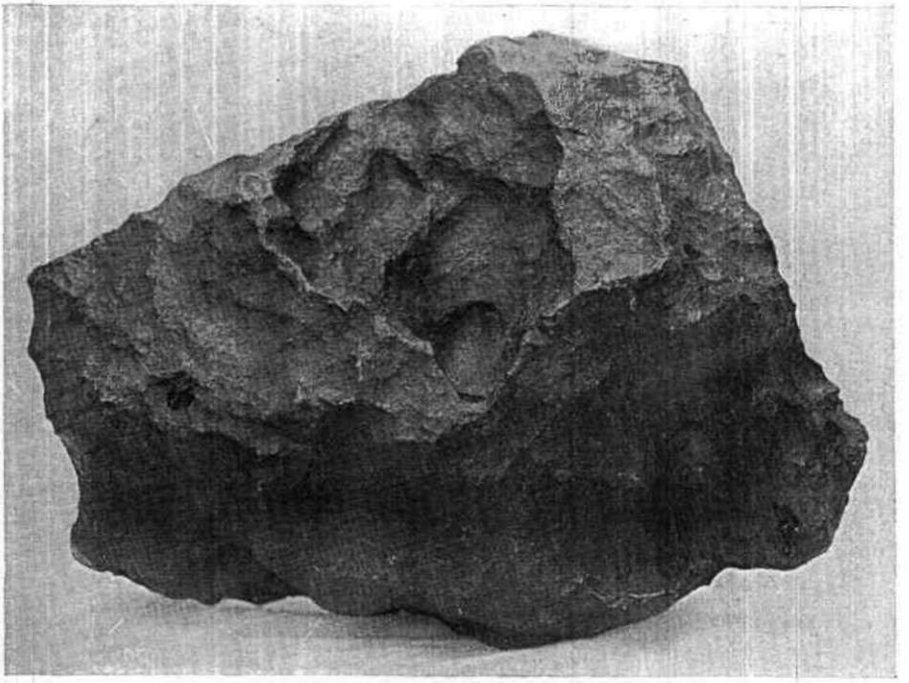

FIG. 1

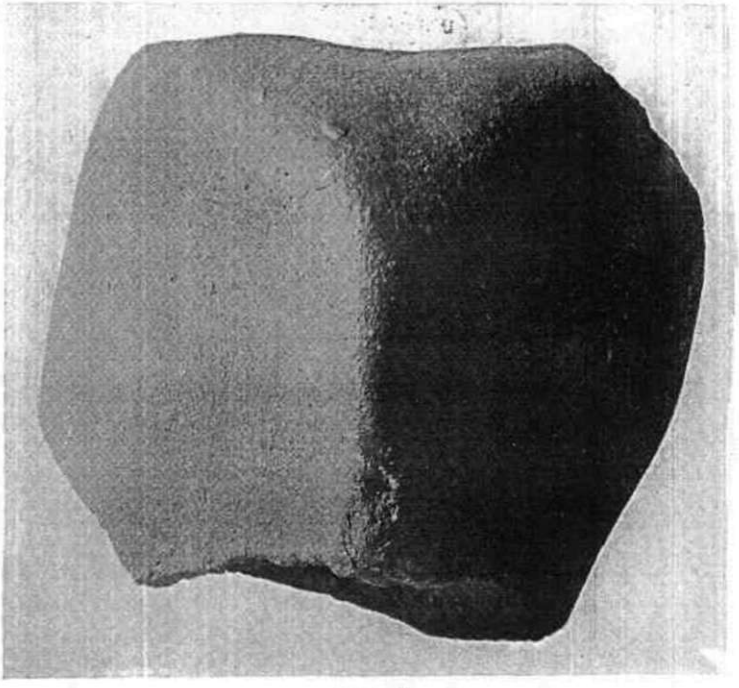

FIG. 2

G. T. PRIOR: THE KAREE KLOOF AND THE SINAI PENINSULA METEORITES.