

Kunz

Glorieta Mountain

THE METEORITES

FROM

Druple

GLORIETA MOUNTAIN, *N. Mex*

SANTA FÉ Co., NEW MEXICO.

BY GEORGE F. KUNZ.

[FROM THE ANNALS OF THE NEW YORK ACADEMY OF
SCIENCES, VOL. III, No. 11, 1885.]

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XVIII.—*The Meteorite from Glorieta Mountain, Santa Fé Co.,
New Mexico.*

BY GEORGE F. KUNZ.

Read Nov. 30, 1885.

On August 9th, 1884, three large masses of meteoric iron were found by Mr. Charles Sponsler, on the ranch of Mrs. Roival, near Canoncito, Santa Fé Co., New Mexico, five miles from the summit of Glorieta Mountain, and three and a half from Glorieta Post Office. Mr. Sponsler, who was prospecting at the time, supposed that he had stumbled upon a mineral of some value, but as yet I have had no word from him, and for the exact information I am indebted to Mr. J. H. Bullock, who, during the month of August, 1885, thoroughly examined and dug over the ground, working about six weeks steadily, and was rewarded by securing three more masses. In the meanwhile, a Mexican had also found a small piece, making seven fragments thus far obtained. This latter piece disappeared with the Mexican before I could secure it.

No. 1 weighs $148\frac{1}{2}$ lbs. (67.35 kilos). About one-third of the whole surface shows the disjuncture very plainly, as also the exact point where this began. The mass measures $15\frac{1}{2}$ inches (39 cm.) in length, 12 inches (30 cm.) in width, and $8\frac{3}{4}$ inches (22 cm.) at the thickest part, and at the thinner 5 inches (12 cm.). One portion has a peculiar bubbled pasty appearance, as if the mass had been cooled in water at this point. Some of the depressions on the surface, or pittings, are 5 cm. across, and quite deep and well-marked. The upper figure on plate XXIII represents the torn side of this mass. Plate XXVI shows the Widmannstätten figures produced by etching a surface of an entire cut from No. 1; this plate is printed from an electrotype taken directly from the etched slab.

No. 2 weighs 115 lbs. (52.38 kilos.), and measures $16\frac{1}{2}$ inches

(41 cm.) in length, 10 inches (24 cm.) in width, and $6\frac{1}{2}$ inches (16 cm.) in thickness. About one-third of the surface of this piece shows the remarkable rupture, the remainder being covered with the pittings. On one corner there is a portion, 10 inches by 6, which is evidently the spot where the mass struck the rock. Here the pittings are flattened and the whole mass distorted and curled over, giving it a radiated or fan-like appearance. The front, or pitted, side of No. 2 is well exhibited in Plate XXI, and the torn side in Plate XXIII, lower figure plate.

No. 3 weighs $53\frac{1}{2}$ lbs. (24.263 kilos.), and measures 12 inches (30 cm.) in length, $8\frac{1}{2}$ inches ($21\frac{1}{4}$ cm.) in height, and 6 inches (15 cm.) in thickness in the thickest part. Over five-sixths of the entire surface is pitted, some of the depressions being 5 cm. across and nearly 2 cm. deep. The place of rupture is plain, and the iron here is coarsely fibrous, possibly because it was farther from the point of impact. There is also a fissure about 4 inches (10 cm.) deep and nearly 1 cm. wide, opposite the broken face. In this fissure are two ends of chisels which were broken in the attempt to pry off this piece, and which may have enlarged the opening. The front side of No. 3 is shown in Plate XXII.

All the new masses are as follows :

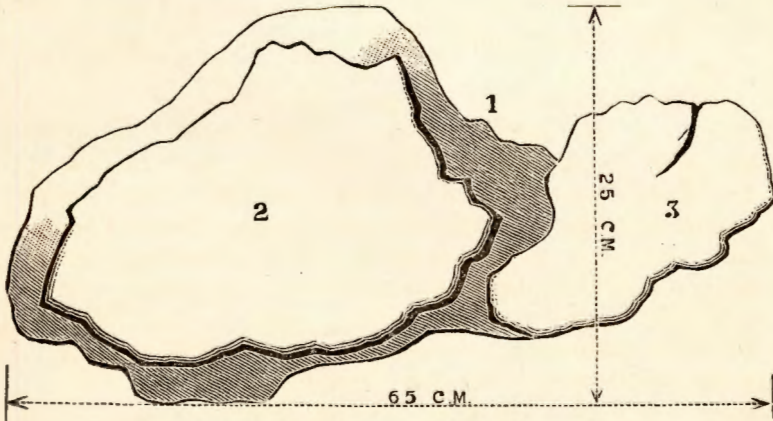
No. 4 weighs 1.204 kilos (2.65 lbs.). One-third of the surface shows the disruption, as in No. 2, the other parts being unaffected and showing the crust surface, Plate XXV. The broken surface is partially drawn out toward the part that was broken off from it, and one edge shows a fracture suggesting cleavage. It is 50 mm. high, 125 mm. long, and 50 mm. wide, or about 2 by 5 by 2 inches. One of the pittings which has been increased in size by the disruption measures 60 mm. in length, 25 mm. in width, and 15 mm. in breadth. (See Plate XXIV.)

No. 5 weighs 1.126 kilos (2.48 lbs.), measures 100 mm. in length, 75 mm. in width, and 48 mm. in height, about 4 by 3 by 2 inches. Five-sixths of the entire surface bears marks of the violent disruption, Plate XXIV, and is undoubtedly from the upper corner, between Nos. 1 and 3. A raised octahedral structure is revealed on two-thirds of its surface, and the pitted side shows evidence of having received a part of the blow, Plate XXV.

No. 6 weighs 1.05 kilos (2.31 lbs.), measures 125 mm. in length, 82 mm. in width, and 45 mm. in thickness at the thickest part, or about 5 by 3¼ by 1¾ inches. It is quite flat, the fracture having left a flat surface suggestive of a cleavage. Altogether this mass closely resembles No. 4. (See Plates XXIV and XXV.)

When the meteorite struck the rock, all these pieces flew asunder; the 148½ lb. piece was found eight feet from the 115 lb. and 53½ lb. pieces, a *fact which shows conclusively that the meteorite did not burst in mid-air*. The small pieces picked up by Bullock and the Mexican were 45 and 50 feet from the large masses, having been hurled further because of their comparative lightness. They were all buried in the vegetable mould covering the rock in places, the larger pieces to the depth of ten inches, but some of the smaller fragments were buried only about three inches.

The accompanying diagram will give a general idea of the relative position of the three pieces:



No. 1 projecting above and below No. 2, as indicated by the shading, and No. 3 fitting in at the lower right hand end. The other four pieces evidently fitted in between the upper end of No. 3 and No. 1. The dimensions of the whole were approximately as follows: length 25 inches (65 cm.), height 10 inches (25 cm.), thickness 15 inches (37 cm.). It is curious that so large and

compact a mass of iron should have been so completely broken asunder, and in this respect the fall is quite unique. The fractures are very clean considering the size of the fragments, although the edges are somewhat irregular. No. 1 is filled with elongated hollows, proving that it was disturbed, and the twistings in No. 2 at the point of impact would lead to the conclusion that the falling body was partly semiplastic; but Prof. R. H. Thurston, who kindly examined the iron, compares the fracture to the effect that is produced by a sudden heavy blow on cold iron, and has observed the same violent wrenching in an iron target used in heavy gunning practice and now at the Stevens Institute, Hoboken, N. J.

In order to separate these large pieces, the force of the blow must have been enormous, for the disrupted surface is over one foot square, and the material as tough as any meteoric iron yet found. That the impact was on a rock may well be proven by the fact that the smaller pieces were torn off as readily as the larger ones. The iron has few signs of weathering, and hence fell recently. It is not deliquescent, and hence contains no chlorine. A red, ochreous, coating from the soil in which it was imbedded, not removable by washing, is a distinguishing characteristic of all the pieces of this iron.

The following is the result of an analysis of a compact piece of iron from No. 3, made by Mr. James B. Mackintosh, E. M., of the School of Mines, New York City :

Fe	-	-	-	-	-	-	-	-	87.93
Ni	-	-	-	-	-	-	-	-	11.15
Co	-	-	-	-	-	-	-	-	0.33
P	-	-	-	-	-	-	-	-	0.36
									99.77

Carbon, sulphur, and other constituents were not determined. The specific gravity of mass No. 2 was taken on a common steel-yard, and found to be 7.66+. The figures may be of interest as showing the homogeneity of the mass, although the method employed was not delicate.

This iron is one of the Holosiderites of Daubr e, and comes under the general group of Caillite of Stanislaus Meunier ; it is

related to the irons of Augusta County, Virginia; Whitfield County, Georgia, and Washington County, Wisconsin. It is of characteristic octahedral structure, and the Widmanstätten figures are made up of kamacite (Balkeneisen or beam-iron), *i. e.*, iron with little nickel, enveloped in taenite (Bandeisen), *i. e.*, iron rich in nickel, and plessite (Fülleisen). On the single cut made, one field of dark plessite measured 17 by 8 mm., the kamacite from 5 to 2 mm. in breadth. The taenite was abundant and brilliant. This is perhaps one of the most beautiful etching irons ever found, as the print from the large section will show. (Folding Plate XXVI.) Nearly all the large mass has been cut into slices, and the iron is seen to be very homogeneous throughout, with the exception of an occasional space measuring 1 to 4 mm. across. One of these spaces, near the centre of the mass, was evidently formed by the shock of disruption. In a few instances this explanation is verified by a palpable curving of the Widmanstätten figures, showing that nearly every part of the thick mass was twisted and wrenched, when it burst with such tremendous force. The ruptures on Nos. 1 and 3 show large patches of troilite. In cutting No. 1 large streaks of this metal and schreibersite were observed, the largest of which was 10 cm. long and 4 mm. wide. Two of the streaks, 10 cm. apart, ran parallel to each other in peculiar crescent like shapes.

Olivine was observed at the upper end of No. 1, a surface about 10 cm. square being completely filled with it. The color in some instances was brownish-golden, or rich yellow, and as plentiful as in the "Pallas Iron." The largest grains observed measured from 8 to 14 mm., and some of these pieces yielded perfect gems over 4 mm. in width.

I was kindly informed by Dr. Whitman Cross, of Denver, Col., that on Oct. 6th, 1884, a meteorite was presented to the Colorado Scientific Society, with descriptive remarks, by Mr. Richard Pearce, of the Boston and Colorado Silver Mining Company. It was sent to the Company from Albuquerque, New Mexico, as silver bullion, and could not be traced further back, although it was probably found in the vicinity of the place from which it was forwarded. Its weight, before cutting, was about 2.5 kilograms, and its dimensions were 45x80x100 mm.

A short paper upon this meteorite was read before the Colorado Scientific Society, on June 1st, 1885, by Mr. L. G. Eakins, of the Geological Survey, containing an analysis of the iron, which is subjoined :

Fe	- - - -	88.760*	Mn	- - - -	trace
Ni	- - - -	9.860	C	- - - -	0.410
Co	- - - -	0.510	P	- - - -	0.182
Cu	- - - -	0.034	S	- - - -	0.012
Zn	- - - -	0.030	Si	- - - -	0.044
Cr	- - - -	trace			
					99.842

This paper by Mr. Eakins appears in the Proc. of the C. S. S. for 1885, and these figures were kindly furnished by him.

The similarity between this analysis and that of the Glorieta meteorite leads me to believe that the Colorado iron is the seventh fragment, which was found by the Mexican, and that he mistook it for silver bullion and disposed of it as such.

* Mean of 88.66, 88.77 and 88.84.

EXPLANATION OF PLATES.

Plate XXI. Front or pitted side of piece No. 2. Two-fifths natural diameter.

Plate XXII. Same of No. 3. Four-ninths nat. diam.

Plate XXIII. Upper figure; torn side of No. 1.

Lower figure; same of No. 2. Both one-third nat. diam.

Plate XXIV. Torn surfaces, Nos. 4, 5 and 6.

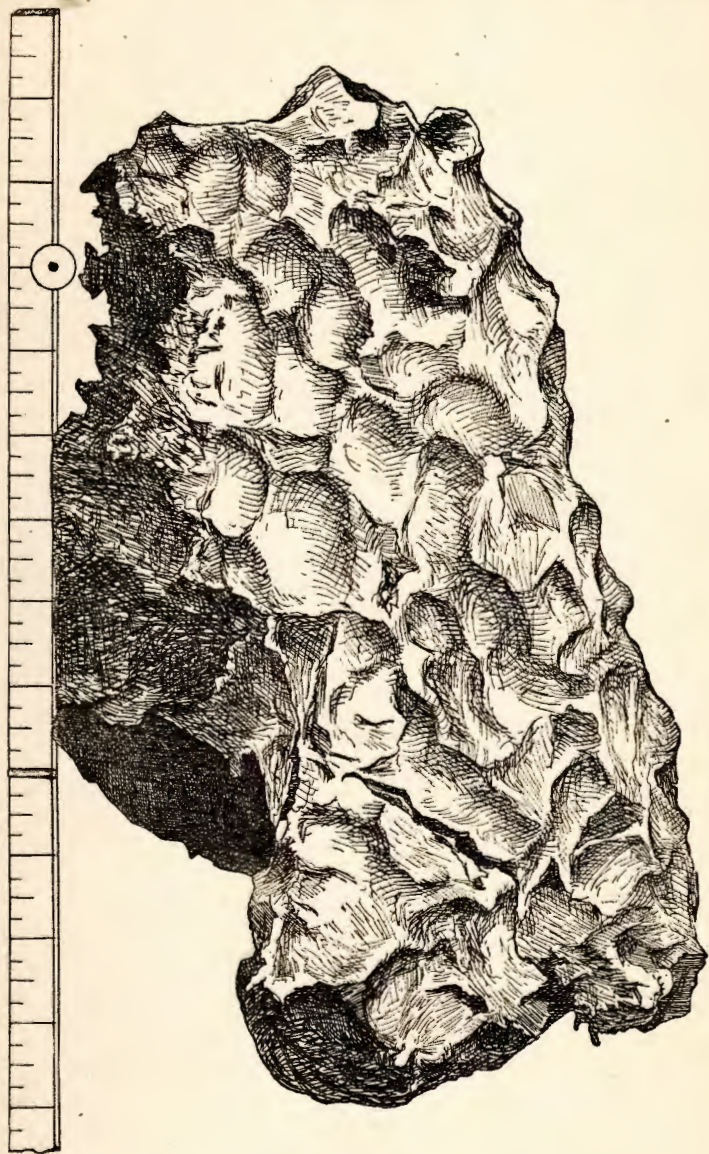
Plate XXV. Crust surfaces of the same. All seven-tenths nat. diam.

Plate XXVI. Etched surface of a cut from No. 1, natural size.

A scale of inches was photographed with the specimens shown on Plates XXI, XXII and XXIII, and appears therefore, correspondingly reduced.



Crust surface. Mass No. 2.
Two-fifths natural size, linear.



Mass No. 3.

Four-ninths natural size, linear.

Now in the collection of the Amer. Museum of Nat. History, New York.