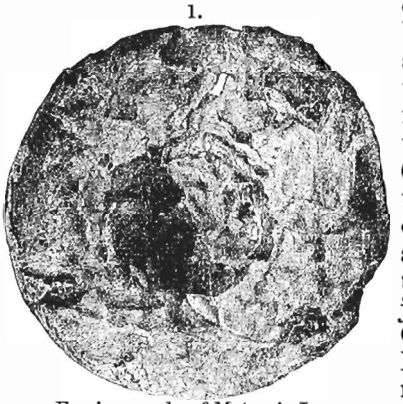
ART. XXVII.—*On two new Meteorites from Carroll County, Kentucky, and Catorze, Mexico;* by GEORGE F. KUNZ.

TWO meteorites have recently come to me for description, which are of more than ordinary interest, both on account of their peculiar composition and structure, and also because of their ethnological relations. The mass from Carroll County, Kentucky, is especially interesting because of its probable connection with the meteoric iron found in the Turner mounds.

1. *Carroll County, Kentucky, Meteorite.*—In the spring of 1883, Professor F. W. Putnam found on the altar of mound No. 3 of the Turner group of mounds in the Little Miami Valley, Ohio, several ear ornaments made (see fig. 1)* of iron and several others overlaid with iron. With these were also found a number of separate pieces that were thought to be of iron. They were covered with cinders, charcoal, pearls (two bushels were found in this group of mounds), and other material cemented by an oxide of iron, showing that the pieces had been subjected to a high temperature. On removing the scale Dr. Kennicutt found they were made of iron of meteoric origin.† One of the pieces weighed 28 and another 52 grams.

1.



Earring made of Meteoric Iron.

In the autumn of 1883, another mass was found on the altar of mound No. 4 of this same group, which weighed 767·5 grams (27¼ ozs.). Dr. Kennicutt suggests that these were all parts of some larger meteoric mass. The results of the inves-

* I am indebted to Professor Putnam for the cuts from which figures 1 and 5 are printed, as also for the information he has kindly furnished me.

† 16–17 Report of Peabody Museum of Archæology, p. 382.

tigation were published in connection with the description of the Atacama meteorites, because in structure they approached more closely to the latter than to those of any other occurrence. In the Liberty group of mounds in the same valley, Professor Putnam found a celt five inches long, and in another of the Turner mounds, an ornament five inches long and three inches wide, made also of this same meteoric iron.

It was not until after the above masses had been found that the Carroll County meteorite was brought to my notice; after a careful comparison I have reached the conclusion that the irons from the Ohio mounds and the Carroll County meteorite

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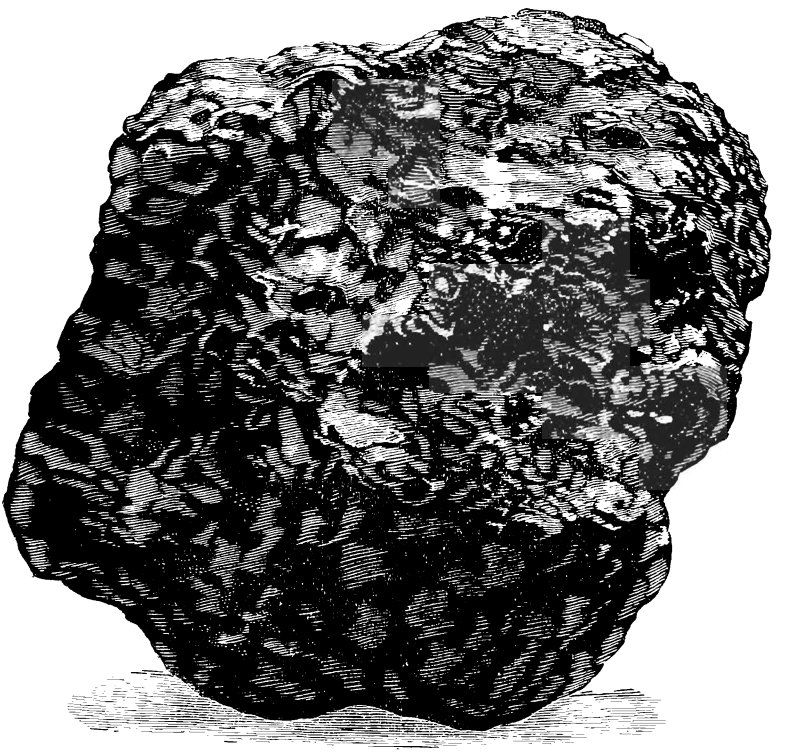


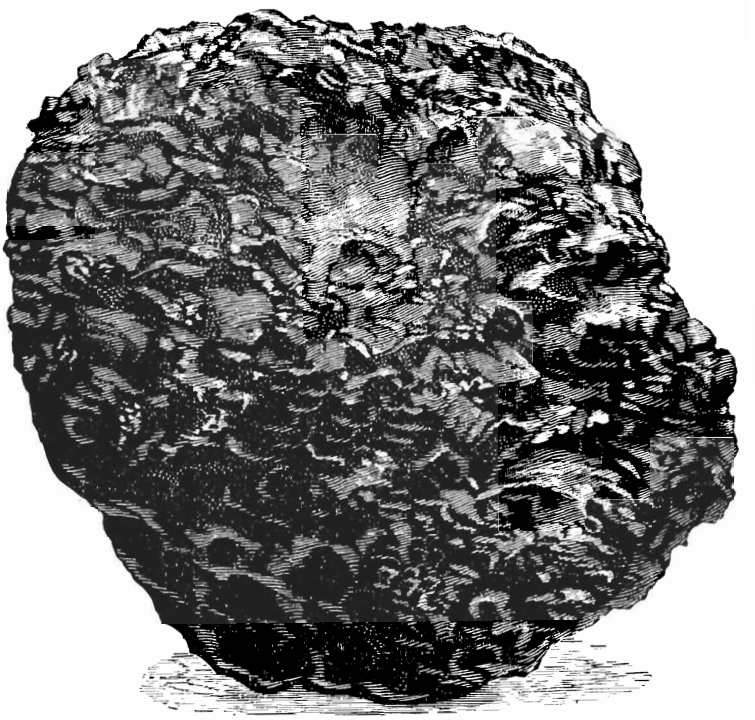
Carroll County Meteorite, upper side, ½ natural size.

probably belong to one and the same meteoric fall. Either the former was broken from the main mass by the mound-builders or they were all fragments of the same fall scattered as were the Estherville meteorites, or as suggested by Dr. J. Lawrence Smith, those of Coahuila, and further, by Huntington,* the Sevier, Cocke County, and Jenny's Creek irons.

* This Journal, III, xxxiii, p. 115.

The Carroll County meteorite was found in 1880, about $\frac{3}{4}$ of a mile from Eagle Station, Carroll County, Kentucky, ten miles from the mouth of the Kentucky River and about seven miles in a direct line from both the Kentucky and the Ohio Rivers. The distance to the Turner mounds, where Professor Putnam found the meteoric iron and the ornaments made of it, is about 60 miles. The mass, which weighs about 80 lbs. or 36·5 kilos (figs. 2 and 3), is almost square, measuring 19^{cm} (7$\frac{1}{2}$

3.

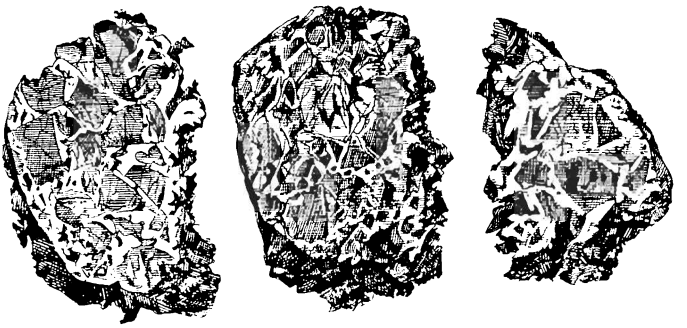


Carroll County Meteorite, lower side, $\frac{1}{8}$ natural size.

inches) in thickness, 22^{cm} (10 inches) in width and 29^{cm} (12 inches) by 29^{cm}, 12 inches in length. The surface is rusted in some places to a depth of 10 to 12^{mm}, and deep pits, some 2^{cm} across, are observed in spots where grains of olivine have probably dropped out. All of the original crust has disappeared. The mass is largely made up of fine yellow, transparent olivine, resembling closely that of the famous Pallas iron. This meteorite belongs to the siderolites or "syssidères" of Daubrée, and the Pallasite group.

Figure 4 shows three sections of the Carroll County mass, the

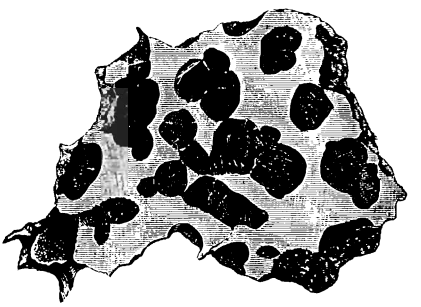
4.



Sections of the Carroll County Meteorite. Natural size.

light portions representing the iron and the dark portions the olivine. Figure 5 shows a similar section made by Dr. L. Kennicutt, of the Turner Mound mass. The specific gravities

5.



Section of the iron from the Turner Mounds.

of the three sections figured are given below, with those of the Atacama and Turner's Mound meteorites.

No.	Carroll County.		Turner's Mound.	Atacama.
1	4·21	mean	4·72	4·35
2	4·379	4·41		
3	4·66			

Taking the specific gravity of the iron at 7·6, and that of the olivine at 3·3, we find that all of these meteorites consist of about three parts of olivine to one part of iron. The iron in the Carroll County meteorite is scarcely more than sufficient to hold the mass together securely, as the olivine is in so much larger crystals than in the Atacama meteorite. On etching, small, fine Widmanstätten markings are produced. By re-

flected light minute crystals of bronzite can easily be recognized, and analysis showed the presence of chromite in fine grains and a very small quantity of schreibersite. The analyses of the olivine and iron were kindly furnished by Mr. James B. Mackintosh of Lehigh University. The sample of the iron taken was selected, as he states, as carefully as possible, to ensure purity, but it was found impossible to free it entirely from earthy matter. The sample of olivine was also somewhat contaminated with foreign matter.

	1.	1a.		2.		
Olivine,		G.=3·47.		Metallic Portion.		
SiO_2	37·90	39·36	Fe	73·44	or Fe	71·73
MgO	41·65	[41·83]*	Ni	14·27	Ni	14·27
FeO	19·66	18·81	Co	0·95	Co	0·95
MnO, CoO	0·42	----	P	0·05	P	0·05
	99·63	100·00	SiO_2	4·23	Olivine	11·12
			MgO	4·69	Chromite	0·90
			Chromite	0·90		99·02
				98·53		

* By difference.

The balance in the last analysis is oxygen in the form of iron oxide, and undetermined constituents. For the pure metallic portion we obtain then A below, or B on the assumption that the deficiency in the analysis is chiefly oxygen combined with iron as magnetic oxide.

	A.	B.
Fe	82·45	81·92
Ni	16·40	16·90
Co	1·09	1·12
P	0·05	0·06
	100·00	100·00

For comparison, analyses of the olivine and iron from the Turner mound and Atacama meteorites are added.

Olivine.				Iron.		
Turner Mound.* G.=3·336.		Atacama.† G.=3·33.		Turner Mound.*		Atacama.‡
SiO	40·02	----	36·92	Fe	89·00	88·01
FeO	14·06	Fe_2O_3	17·21	Ni	10·65	10·25
MnO	0·10	Mn_2O_3	1·89	Co	0·45	0·70
MgO	45·60	----	43·90	Cu	tr.	----
				P	----	0·33
				Na	----	0·21
				K	----	0·15

* Kennicutt, loc. cit. † Schmid, Pogg. Ann., lxxxiv, 501.
‡ Buchner, Die Meteoriten, Giessen, p. 195, 1859.

2. *Catorze meteorite.*—The Catorze mass (fig. 6), weighing 92 lbs., was found by a miner near Catorze, San Luis Potosi,

6.

Catorze Meteorite; ⅛ natural size.

Mexico, in 1885. It is 31·5^{cm} (12½ inches) long, 34·5^{cm} (13¾ inches) wide, and 20^{cm} (8 inches) thick. It shows beautiful raised octahedral markings. On one side an opening 9^{cm} (3½ inches) long has been made, and a piece of a chisel of native copper left wedged in it (fig. 7). This piece, which is partially covered with oxide of copper, is 22^{mm} (⅞ inch) long on one side, 33^{mm} (1¼ inch) on the other, and 14^{mm} wide.

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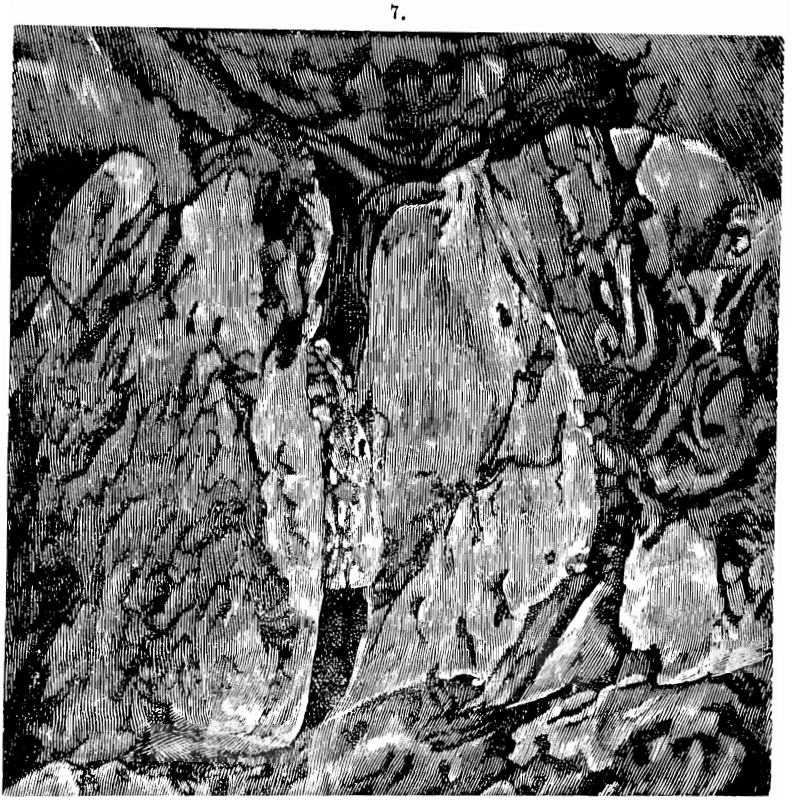
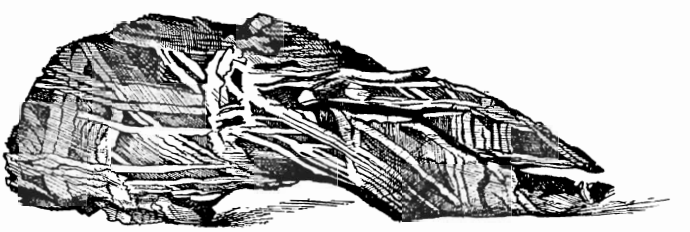


Catorze Meteorite, showing copper chisel (*c*); natural size.

This iron is one of the Caillite group of Stanilas Meunier and shows the Widmanstätten lines very finely (see fig. 8),

8.



Catorze Meteorite, Widmanstätten Figures; natural size.

It resembles the irons of Augusta County, Virginia, of Glorieta Mountain, and others of this group. No troilite was observed, the mass having been cut very little, and schreibersite is only sparingly present.

The specific gravity of the piece was found to be 7·509, the analysis by James B. Mackintosh, E.M., of Lehigh University, is given below. To this are added analyses of masses found nearest to Catorze, since G. V. Bogulawski suggests that perhaps the Charcas, Zacatecas and Durango irons were all parts of one fall.*

	Catorze. Mackintosh.		Toluca. Wöhler.[1]	Toluca. Wöhler.[1]	Charcas. Stan. Meunier.[2]
Fe	90·09		90·43	87·894	93·01
Ni	9·07		7·62	9·056	4·32
Co			0·72	1·070	
P	0·24		0·15	0·620	----
Scale insoluble in HNO_3	0·60	Insoluble in HCl.	0·34	0·224	0·70
Schreibersite	----		0·56	0·344	----
S	----		0·03	----	----
CuSn	----		0·03	----	----
Mn	----		----	0·201	----
	100·00		99·88	99·409	98·03
Sp. gr.	7·509				

[1] Wöhler Sitzber. K. Akad. Wiss., xx, 217. [2] Meunier, Encycl. Chim., ii, 118.

Del Rio† mentions that two of his pupils found above the Aqua Blanca Estate, native iron in a conglomerate rock in a vein from one to two fingers in width. Burkart‡ says that he saw, in the possession of Señor Chialiva in Zacatecas, a mass of meteoric§ iron weighing between ten and twelve pounds that was said to have been found in the vicinity of Catorze—or rather Alamos de Catorze as it is known—which is in San Luis Potosi, about 200 miles southwest of Durango, 40 miles north of Charcas, and 340 miles north of Toluca. There is also in the Museo Nacionale of the City of Mexico a mass‖ weighing 576 kilos which was found at Descubridora in San Luis Potosi; it was described in 1873.

The well-known Charcas mass, weighing 780 kilos, was found in the corner of the church at Charcas, San Luis Potosi, Mexico, by some French soldiers and taken by them to Paris in 1866. This mass was first mentioned by Sonnenschmid,¶ and afterwards by Humboldt.** From all appearances, however, I am inclined to believe that the iron now under consideration is a new and distinct fall.

* Pogg. Ann., iv, 1, 1854. † Tablas Mineralogicas, vol. i, p. 57; ii, p. 40.

‡ Neues Jahrbuch für Mineralogie, 1856, p. 286.

§ Perhaps part of the iron here described, since it showed an old break on one side.

‖ A specimen of this iron in the Yale University Collection, received from Professor Barcena is accompanied by a copy of an analysis by P. Murphy, as follows: Fe 89·51, Ni 8·05, Co 1·94, S 0·43, Cr and P 0·95=100.—Eds.

¶ Berg. Rev., Mexico, p. 228, 1804.

** Essai Politique, Paris, 1811, vol. iv, p. 107.