THE SHARPS METEORITE, RICHMOND COUNTY, VIRGINIA.[1]

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The meteoric stone described below was received by the writer from Prof. Donald W. Davis, of the College of William and Mary, Williamsburg, Virginia, to whom he is indebted for the privilege of describing it. He is also indebted to Professor Davis for the information relative to the fall of the stone. Through the courtesy of Dr. George P. Merrill, of the United States National Museum, Washington, D. C., the meteorite was photographed, three casts made of it, and the stone sliced into three parts, one portion and cast each being sent to Professor Davis, the other two casts and portions being deposited in the collections of the United States National Museum and the University of Virginia.

According to information furnished by Professor Davis, the stone is reported to have fallen April 1, 1921, on the farm of F. W. Motley, a resident of Sharps, Richmond County, Virginia. Its fall was observed by Grant Yates, a colored resident of Sharps, who was working at the time in a field on the Motley farm. It is reported that Yates's attention was attracted by a whirring sound or noise which he could not account for and which badly frightened him but, on looking up, he observed " a falling body followed by a small tail of fire." The stone fell about 90 meters (100 yards) from Yates in ploughed ground and, according to his statement, was buried to a depth of 38 centimeters (15 inches). When he dug it up, it is reported to have " smelled strongly of brimstone." It will be known as the Sharps meteorite, and is the second stone thus far found within the State.

The total weight of the stone as received was 1,265 grams or about 3.4 pounds (troy) ; the specific gravity as determined on the entire mass was 3.53. The shape of the stone is shown in Plate 1, Figure 2. The dimensions are approximately 11.5, 7.5, and 6.5 cm. It is bounded by eight irregular, smooth faces of unequal size, which meet in edges that are well rounded. Three of the faces adjacent to each

[1] For the photographs produced as Plate 1, fig. 1, and Plate 2, figs. 1 and 2, the writer is indebted to the United States Geological Survey, and Plate 1, fig. 2, to the United States National Museum.

other are concave, and each is characterized by smaller concavities or pits; the surfaces of the three faces being formed of a smooth black skinlike coating. The other faces are lighter in color (dark gray), several of which are only slightly concave, and all are essentially free from pits or minor concavities. Examination of the stone, especially the lighter-colored portion, clearly shows it to be tuffaceous in texture, which is pronounced in thin section under the microscope.

Thin sections under the microscope show the stone to be a crystalline spherulitic chondrite composed chiefly of olivine and enstatite and a considerable sprinkling of metallic iron. Plate 1, Figure 1, a composite photograph of the sawn surface of the stone, emphasizes in the right half the metallic portion shown in the tiny bright white spots, and in the left half, taken with the light at a different angle, the rock or silicate portion.

Microscopically, thin sections of the stone show it to be composed of chondrules of olivine and enstatite set in a dark brown groundmass composed of a mixture of particles of metallic iron and small fragments of the silicate minerals (pl. 2, figs. 1 and 2). The exact nature of the groundmass is largely obscured in most of the thin sections studied, due to the general presence of iron oxide stain derived from oxidation, which also frequently partially discolors the chondrules and large fragments of silicates. However, treatment of a thin section of the stone with dilute hydrochloric acid to remove the stain of iron oxide clearly shows the composition of the groundmass to be a mixture of metallic iron and small fragments of the silicate minerals olivine and enstatite. The general structure of the stone, which is characteristically tuffaceous, is shown in Figures 1 and 2 of Plate 2.

The metallic iron forms small particles of irregular shapes distributed through the groundmass as interstitial filling between the chondrules, as tiny particles inclosed in the chondrules, and occasionally as minute granular films between the fibers of the enstatite chondrules which show radiate structure. It sometimes forms partial rims or borders about the chondrules.

Chondrules of several types occur as shown in Figures 1 and 2 of Plate 2. They vary from holocrystalline to those composed of part glass and porphyritic, the outlines of which are usually sharply differentiated from the matrix. Some are of the radiate enstatite type which may show an excrescence or saucer-shaped depression (pl. 2, fig. 1), but most of them are of the glass porphyritic type composed either of olivine or of a mixture of olivine and enstatite in a glass base (pl. 2, fig. 2). An occasional barred form composed of olivine occurs. Plate 2, Figure 1, shows two large chondrules of the radiate enstatite type which, under cross nicols, exhibit pronounced cone-shaped extinction.

The ratio of phenocrysts to glass base in the glass porphyritic type of chondrule is subject to some variation, but the phenocrysts are always in excess (pl. 2, fig. 2). Except for a rare euhedral olivine phenocryst both the olivine and the enstatite of the chondrules are fragmental in appearance and are of angular or subangular outline. In origin Doctor Merrill regards these as "rock fragments reduced to their present form through mechanical attrition."[2] He says: "In brief, their present structural peculiarities, both external and internal, are entirely inconsistent with any conceivable theory of origin but that of detrital particles from solidified magmas."

The fragmental nature of the stone is strikingly shown in the angular fragments of both olivine and enstatite set in the dark brown ground. Some of these approach in size the larger chondrules, with smaller broken, angular ones of the same composition and form, so distributed about the larger ones as to afford unmistakable evidence of mechanical derivation.

A large number of measurements made on thin sections of the stone showed the chondrules and silicate fragments to range in size from a maximum of 0.63 mm. by 0.56 mm., and a minimum of 0.008 mm. by 0.008 mm. Of the total number of measurements, 37 per cent were equidimensional bodies, 52 per cent were of bodies whose diameters were in the ratio of 1.2 to 1.8, and 11 per cent exceeded the ratio of 2 to 1.

The following analysis of the Sharps stone I am permitted to use through the courtesy of Dr. George P. Merrill, of the United States National Museum, for whom it was made by Dr. J. E. Whitfield under a grant from the National Academy.

	Per cent.
Metallic portions	9. 69
Rock material	87. 89
Troilite	2. 42
	100. 00

The metallic portion has the following composition:

	Per cent.
Iron	88. 54
Nickel	9. 91
Cobalt	1. 39
Phosphorus	trace
Sulphur	0. 15
	99. 99

The silicate portion freed from metal and troilite has the composition given in column 1 below, and recalculated with the proportionate amounts of metal and troilite as already given, in column 2.

[2] Merrill, G. P.: On Chondrules and Chondritic Structure in Meteorites. Proc. Natl. Acad. Sci., vol. 6, p. 449, 1920.

	Per cent.	Per cent.
Silica	42.98	37.775
Ferric oxide	0.16	0.138
Ferrous oxide	18.35	16.137
Phosphoric acid	0.23	0.22
Alumina	3.31	2.90
Manganous oxide	0.36	0.32
Lime	3.03	2.66
Magnesia	28.52	25.05
Nickel oxide	0.48	0.42
Cobalt oxide	trace	------
Sulphuric anhydride	1.44	1.26
Soda	0.93	0.82
Potash	0.21	0.18
	100.00	87.88
Troilite		2.42
Metal		9.69
		99.99

Of the nine meteorites thus far recorded from Virginia, including the Sharps stone, seven were iron and two stone meteorites. They were distributed by provinces as follows: Four in the Mountain province west of the Blue Ridge, two in the Floyd-Carroll-Grayson counties plateau of the Blue Ridge, one in the Piedmont Plateau province, and two in the Coastal Plain province. Both the Sharps meteorite and one recorded as having fallen at Richmond, Henrico County, Virginia, June 4, 1828, are crystalline spherulitic chondrites.

EXPLANATION OF PLATES.

PLATE 1.

The Sharps, Virginia, Meteorite.

FIG. 1. Composite of a sawn surface of the stone. Right half emphasizes the metallic content in the tiny white dots, left half the stony (rock) content.

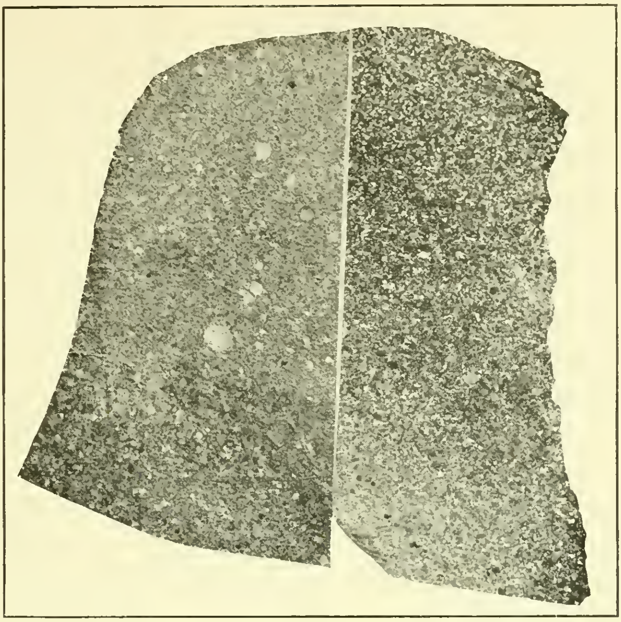
2. The stone as it was received from Professor Davis.

PLATE 2.

Microstructure of the Sharps, Virginia, Meteorite.

FIG. 1. Black, groundmass of a mixture of metallic iron and small fragments of silicate minerals; white, chondrules of enstatite and olivine. Two large chondrules of the radiate enstatite type with saucer-shaped depression and smooth outline sharply differentiated from groundmass are shown in the right and left portions of the figure.

2. Shows the pronounced fragmental (tuffaceous) character of the stone. Black, groundmass of a mixture of metallic iron and small fragments of silicate minerals; white, chondrules of glass porphyritic type and smaller angular fragments of olivine and enstatite, both usually sharply differentiated from the black groundmass. Note the rounded outline of some chondrules and the contrasted ragged, angular outline of others.



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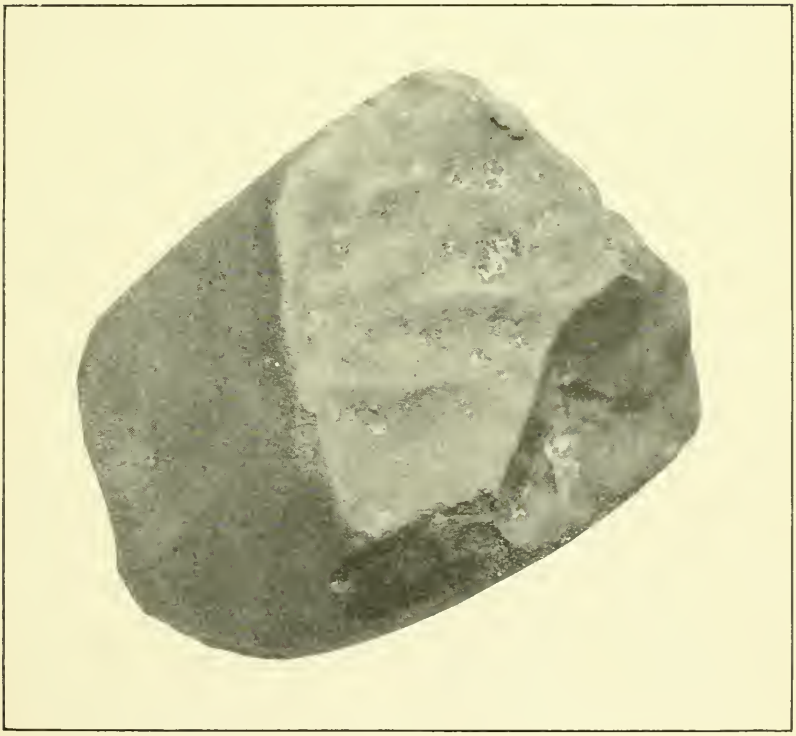

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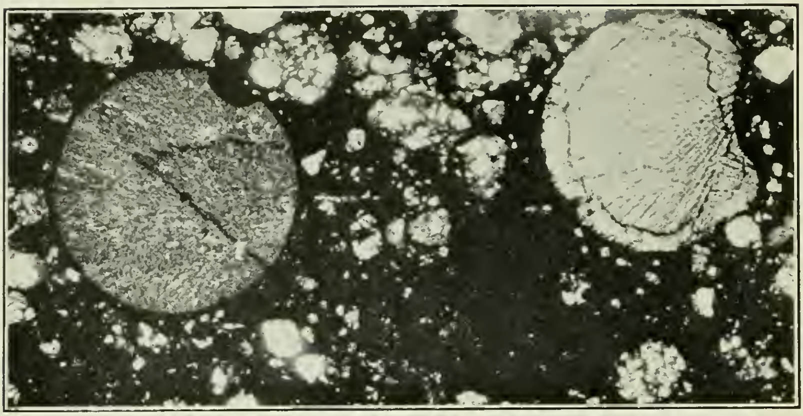
THE SHARPS, VIRGINIA, METEORITE

FOR EXPLANATION OF PLATE SEE PAGE 4.



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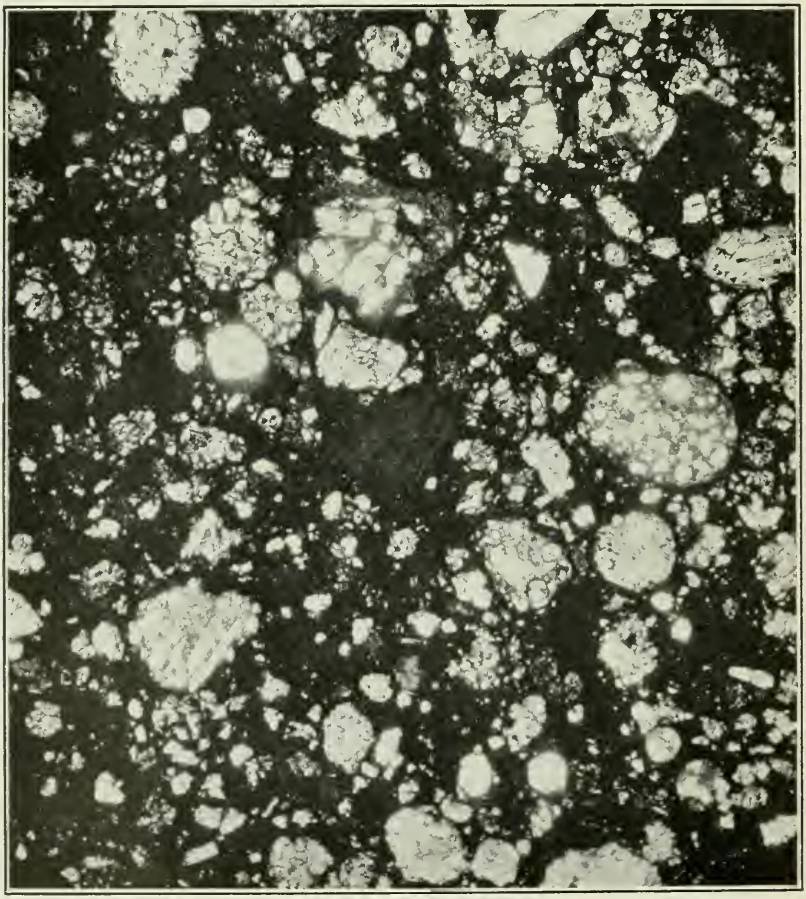

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MICROSTRUCTURE OF THE SHARPS, VIRGINIA, METEORITE

FOR EXPLANATION OF PLATE SEE PAGE 4.