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Through the courtesy of Mr. F. C. Chekal, editor of the *Holbrook News,* the U. S. National Museum recently came into possession of four pieces of a meteoric stone which fell near the little railroad station of Aztec, on the Santa Fe Railroad, some six miles east of Holbrook, Arizona. It is this material which forms the subject of the present paper, the data regarding the fall being derived from the account in the *Holbrook News,* supplemented by correspondence with Mr. Chekal.

According to the printed account, the fall took place about 7.15 on the evening of Friday, July 19, 1912. It was accompanied by "a heavy explosion similar to that of a heavy blast, followed by a fusillade of smaller explosions which terminated in a thunder-like rumble of approximately two minutes duration. . . . The sky was lightly overcast with patches of high floating clouds, but immediately after the explosion a smoky trail similar to the exhaust of an automobile was visible. The trail disappeared in a direction a little north of east. The volume of the explosion can be best judged by the fact that it was heard at White River on the south, and at Kean's Canyon on the north, or about one hundred miles north and south of Holbrook. Saturday word was received that a shower of falling stones took place at Aztec, six miles east of here immediately after the explosion was heard. The fall, as near as can be judged, was scattered over an area of more than one square mile."

Through correspondence I learned subsequently that some 250 pounds of complete individuals and fragments have been shipped to Philadelphia, the largest complete stone weighing about 14½ pounds, and that some eight pounds of fragments yet remain in the hands of local collectors, the entire number of individual samples being estimated at some three thousand. In this respect the occurrence would therefore seemingly be a counterpart of the celebrated Pultusk fall, the similarity being further heightened by the lithological

nature of the stone. The total weight of all the known material, accepting the figures given above and adding thereto the weight of that received here, would be approximately 270 pounds, or 122, 580 grams.[1]

Microscopically the stone is of a light ash-gray color closely simulating that of Allegan, Michigan, but is much more firm and compact. Like the Allegan, the particles of native iron are so small as to be scarcely distinguishable by the unaided eye. It differs, however, radically in the size of sulphide particles and in their relative abundance as compared with the iron. Chondrules are abundant but small and quite inconspicuous, and of a color only a shade darker than the ground. They rarely break with the matrix. The largest noted are not over 2 or possibly 3 mm. in diameter. The crust is in all cases lustreless black, or brown-black, sometimes smooth or again roughly chagreen.

The stone is interesting for the small proportion of visible metallic iron and the abundance of iron sulphide, troilite. The latter occurs in granules of all sizes up to 8 mm., and has a peculiar bronze lustre like ordinary terrestrial pyrrhotite. It is, however, non-magnetic, not being affected by an electro-magnet of considerable power, and is unquestionably troilite, as shown by the analysis. It is very brittle. On one of the samples a large nodule, some 6 to 8 mm. in diameter, lying near the surface, has been burnt out to a depth of some 5 mm., the residue having a glazed, somewhat porous surface and much the appearance of a furnace slag. The cavity left is characteristic of the deeper pits common to meteorites and leaves no doubt as to their origin.

Under the microscope the stone resolves itself into a fine but rather loosely compacted aggregate of polarizing particles in which are imbedded the numerous chondrules and large single and clustered imperfectly outlined crystals of an orthorhombic and occasional monoclinic pyroxenes and of olivine with small scattering areas of metallic iron and iron sulphide. The fine loosely aggregated ground is composed of siliceous particles in which only olivine and pyroxenes can be satisfactorily identified. The chondritic structure is obscure and only occasionally recognizable in this section. No well-defined feldspars nor other minerals than those mentioned were identified, and there is little if any true glass. Sections, however, show frequent colorless, nearly isotropic areas, and occasionally a nearly colorless body polarizing faintly in light and dark color, not extinguishing uniformly throughout, and with at times a faint suggestion of polysynthetic twin

[1] See Supplementary Note at end of this article.

structure as in a feldspar. These are often so charged with a black, amorphous powder as to quite obscure their real nature, and it is only by analogy or surmise that one is led to believe them to be maskelynite.[1]

A chemical investigation of the stone by Dr. J. E. Whitfield, of Philadelphia, yielded the results as below:[2]

	Per cent
Schreibersite	0.11
Troilite	7.56
Metal	4.85
Silicates	87.48
	100.00

The metallic portion yielded:

Nickel	8.68
Cobalt	0.64
Copper	0.29
Iron	90.50
	100.11

The silicate portion yielded:

Silica	41.93
Alumina	4.30
Ferrous oxide	21.85
Lime	2.40
Magnesia	29.11
Soda	trace
Manganese protoxide	0.25
Nickel oxide	0.08
	99.92

Specific gravity at 22.6° C. 3.48.

The stone is low in iron, though not unprecedentedly so, and high in sulphur, but otherwise presents no unusual features. A total lack of chlorine is to be noted, but unfortunately this element is so fre-

[1] It may be well to state here that not being satisfied with my determinations of this supposed maskelynite in Coon Butte, Rich Mt., Thompson and other meteoric stones, I submitted uncovered slides of the first mentioned to Dr. F. E. Wright of the Carnegie Geophysical Laboratory. In these he determined the index refraction of the doubtful mineral to be 1.51. According to Larsen's determinations (Amer. Journ. Sci., vol. 28, 1909) on refractive indices of feldspathic glasses, this would relegate it to a feldspar near *oligoclase* in composition.

[2] This analysis is one of several made for the writer under a grant from the J. Lawrence Smith fund by the National Academy of Sciences, to which body he is indebted for permission to use it here.

quently disregarded in analyses that satisfactory comparisons are not possible.

The sulphide separated mechanically and free from metal or silicate impurities, yielded:

	Per cent
Iron	63.62
Sulphur	36.50
Nickel, cobalt and copper	none
	100.12

Specific gravity determined in picnometer flask at 22.6° 4.61. The composition is therefore that of troilite, though the specific gravity is low.[1] The occurrence is contrary to the assumption made by Rose to the effect that the sulphide of the stony meteorites was pyrrhotite. I have discussed this matter further in a paper now in press on a stony meteorite from Cullison, Kansas.[2]

Inasmuch as the station called Aztec above is not a post office station, and as, moreover, there is a post office by this name in Yuma County in the extreme southwest part of the state, and also one in New Mexico, it seems advisable that this name be ignored and the stone be known as the Holbrook meteorite. Following Brezina it would be classed as a spherulitic chondrite, crystalline, Cck.

Supplementary Note.—In the American Journal of Science for November, W. M. Foote gives a detailed account of this fall in which the total weight is estimated at 481⅓ lbs., or 218,310 grams. This is probably more nearly correct than the estimate given me by Mr. Checkal. It will be noted that my determination of the mineral composition is at variance with that given by Foote. I find no free quartz nor spinel, and the chemical analysis reveals no chromium. The "pyrrhotite" I have shown to be troilite.

[1] The iron sulphide of the Bjurbole meteorite is also in the form of troilite, as shown by Ramsay and Börgstrom, Bull. No. 12, de la Commission Geologique de Finland, May, 1902.

[2] Proc. U. S. Nat. Mus., Vol. 43, 1912.