Radiochemical Analysis of the Odessa Siderite.—The Odessa siderite is one of several siderites made available by the Institute of Meteoritics to Dr. Harrison Brown, Institute for Nuclear Studies, University of Chicago, for radiochemical analysis. Brown (1949) analyzed this specimen for gallium and palladium;[3] his results are given in Table 2, row (1). The corresponding results for the Albuquerque, New Mexico, and Canyon Diablo No. 1 and Canyon Diablo No. 2, Arizona, siderites are given in the second, third, and fourth rows, respectively, of Table 2.

TABLE 2

	Gallium (Ga)	*Palladium (Pd)*
Odessa	69.3 p.p.m.	4.15 p.p.m.
Albuquerque	90.5	4.46
Canyon Diablo No. 1	77.4	3.98
Canyon Diablo No. 2	85.0	5.30

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The Glorieta Mountain, New Mexico, Siderite (ECN= + 1058,356)*

CARL W. BECK, LINCOLN LAPAZ, *and* RALPH G. STEVENSON, JR.

University of New Mexico, Albuquerque

ABSTRACT

The history of the recovery of the masses that comprize the Glorieta Mountain, New Mexico, siderite is reviewed. The present paper is based on a detailed mineralogical, metallographical, and chemical investigation of the remarkable cane-shaped specimen from the Department of Geology of the University of New Mexico. The meteoritic constituents present are kamacite, taenite, plessite, schreibersite, and lawrencite. The meteorite is classified as a medium octahedrite (Om).

INTRODUCTION

The first recoveries from the Glorieta Mountain, New Mexico, sideritic fall were made by Mr. Charles Sponsler on August 9, 1884, on the ranch of Mrs. Roival, near Canoncito, Santa Fe County, New Mexico

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(ECN = + 1058,356). Mr. Sponsler, who had been prospecting on the Roival Ranch, imagined that he had stumbled upon a valuable ore deposit, despite the fact that the mass was found lying on top of a rock! The impact with the rock had shattered the meteorite into 3 fragments. Subseqently to Sponsler's initial discovery, Mr. J. H. Bullock, beginning in August, 1885, spent about 6 weeks in a careful examination of the area in which the masses of meteoritic iron had been found, and, as a result of his search and excavations, discovered 3 more masses of the fall. Since the discoveries made by Sponsler and Bullock in 1884 and 1885, the finding of an occasional, additional fragment of the Glorieta Mountain meteorite has been reported from time to time. At least 2 of these more recent finds (Albuquerque and Pojoaque) were initially assigned incorrectly to localities remote from Glorieta Mountain, but are now accredited to the shower that fell on and near the Roival Ranch.

In the order of decreasing size, the 6 masses found by Sponsler and Bullock may be described as follows: No. 1 weighs 148.5 pounds and clearly exhibits a surface of disruption; No. 2 weighs 115 pounds and shows not only a surface of rupture like that on No. 1 but also a flattened portion, 10 × 6 inches, which has been interpreted as the surface area that actually struck against the rock; No. 3 weighs 53.5 pounds and also shows a surface of rupture; No. 4 weighs 2.65 pounds and shows the effects of disruption over one-third of its surface, the area of fracture showing coarsely fibrous iron drawn out in the direction of the missing part; No. 5 weighs 2.48 pounds, and approximately five-sixths of the entire surface bears marks of violent disruption; No. 6 weighs 2.31 pounds and is very flat, the fracturing of the mass having left a nearly plane surface suggestive of a cleavage.

G. F. Kunz (1886),[1] after careful examination of Nos. 1 to 6, concluded that all of these pieces were fragments of a single large meteorite that "flew asunder" when it struck the rock on the Roival Ranch. He noted that the 148.5-pound piece was found only 8 feet from the 115-pound and 53.5-pound pieces, a fact that, in his opinion, demonstrated conclusively that the meteorite had burst on impact with the rock and not while traversing the air. Even the small fragments, Nos. 4, 5, and 6, were found at not more than 45 or 50 feet from the large masses, having been hurled to such distances because of their light weight. All of the fragments were buried at depths of from 3 to 10 inches in the vegetable mold that covers the solid rock in many places. Kunz attempted to reconstruct the original single mass from these 6 fragments, arriving at an individual with a length of 25 inches, a height of 10 inches, and a thickness of 15 inches (Kunz, *loc. cit.*,[1] p. 329).

In contrast to the opinion Kunz formed concerning the fragmentation of the meteorite, Brezina (1895; *loc. cit.*,[2] p. 280) regarded Glorieta Mountain as a siderite that, like Butsura, India (ECN = ∓841,271; cl. = C, i) had burst before reaching the Earth and had suffered partial fusion after the separation of the pieces in the air. In support of this view, Brezina called attention to the striking differences between the smooth surfaces, coated with fusion crust, which he interpreted as parts of the primary face, and the areas characterized by hackly fracture, occasionally slightly fused, which he regarded as the secondary surfaces.

A chemical analysis of fragment No. 3 of Glorieta Mountain, by James B. MacKintosh of the School of Mines, New York City, gave the following results: Fe = 87.93%; Ni = 11.15%; Co = 0.33%; P = 0.36%; total = 99.77%. No other elements were determined.

A chemical analysis of the 7th mass recovered from the Glorieta Mountain fall was made by L. G. Eakins, with the following results: Fe = 88.760%; Ni = 9.860%; Co = 0.510%; Cu = 0.034%; Zn = 0.030%; Mn = trace; P = 0.182%; S = 0.012%; Si = 0.044%; total = 99.432%. Eakins regarded this analysis as corresponding to the following mineral composition:

Nickeliferous iron	98.224%
Troilite (FeS)	0.033
Schreibersite (Ni_2Fe_4P)	1.175
Total	99.432%

Altho Cohen, Weinschenk, and Brezina have studied certain features of the Glorieta Mountain meteorite, this siderite has not received the attention that its many meteoritic characteristics merit. The present paper is based on a mineralogical, metallographical, and chemical investigation of a remarkable specimen of the Glorieta Mountain fall (No. IOM-7 in the collection of the Institute of Meteoritics), weighing 3 pounds and 12 ounces.

Found by L Ortiz on "Apache Canyon Ridge" 1-19-54. He was forcing his way thru a patch of brush + first thought the object was an old crushed pipe.

13 probably

Macroscopic Examination

A macroscopic examination of this specimen of the Glorieta Mountain fall reveals that the specimen is a club-shaped, or cane-shaped, siderite, 23 cm. long, with a cross-section about 4 cm. in each direction at the widest part (Fig. 1A). The specimen has been sliced, polished,

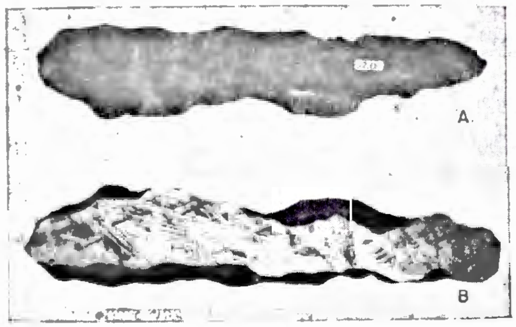

Fig. 1
The Glorieta Mountain, New Mexico, Siderite: A. Exterior Surface; B. Macroetched Surface; Scale in Inches

and macroetched along one side (Fig. 1B). Small sections have been removed from one end, one a cross-section and one a section parallel to the long axis, in order to make polished sections for metallographic study.

The weathered surface is characterized by angular pittings. The angularity of these pits is a rather unusual feature of meteoritic irons. The long club-shaped, or cane-shaped, habit of this specimen of the Glorieta Mountain fall also is unusual. The color of the weathered surface is the reddish-brown so common to siderites.

The macroetched surface shows the iron to be a medium octahedrite (Om). The kamacite plates, which range in thickness from 0.4 to 1.0 mm., traverse the surface in as many as 4 directions. The kamacite plates are bounded by thinner taenite lamellae, and the angular interstices are filled by plessite fields. A few small areas have been deeply etched and appear granular. It is thought that this granular appearance indicates areas that had a loosely granular structure before etching and were more deeply etched because of the greater surface area exposed to the dissolving action of the etchant.

This fall consists of a number of irons, some of which are said to possess pallasitic areas, or areas containing large grains of olivine enmeshed in a network of nickel-iron. The specimen studied for this report exhibits no such pallasitic areas, however.

Microscopic Examination

Two (2) slices of the Glorieta Mountain siderite, one cut parallel to the long axis of the specimen and the other at right angles to it, were mounted in bakelite, polished, etched with nital for 15 sec., and studied with the metallographic microscope. Examination of the polished sections before etching revealed small amounts of lawrencite (Fig. 2A) with a random distribution. The lawrencite appears to be concentrated along boundaries of kamacite grains or along fractures in kamacite plates. The chemical analysis (Table 1) shows the presence of appreciable chloride.

The microscopic examination confirms the structure as being that of a medium octahedrite (Om). The majority of the kamacite lamellae fall in the range of 0.25 to 1.0 mm., tho some extremely fine lamellae (0.05 mm.) and some thick lamellae (up to 1.75 mm.) are evident in the sections.

The external zone of alteration is not very great, reaching a maximum depth of 0.5 mm. The interior of the siderite, with the exception of the aforementioned lawrencite, is free from alteration. From the unaltered appearance of the meteoritic constituents, as well as from the lack of extensive external oxidation, it may be inferred that the meteorite did not undergo severe heating during its flight thru the atmosphere.

The meteoritic constituents present are kamacite, taenite, plessite, lawrencite, and a small percentage of schreibersite. The principal component is kamacite, in bands crossing one another in as many as 4 directions, to give the octahedral structure. For the most part, the kamacite is structureless, tho occasionally Neumann lines are seen.

Taenite occurs either as thin lamellae bordering the kamacite or as highly irregular, angular grains in light plessite, or as a component of dark plessite (Fig. 2C). The bordering taenite is thickest where 2

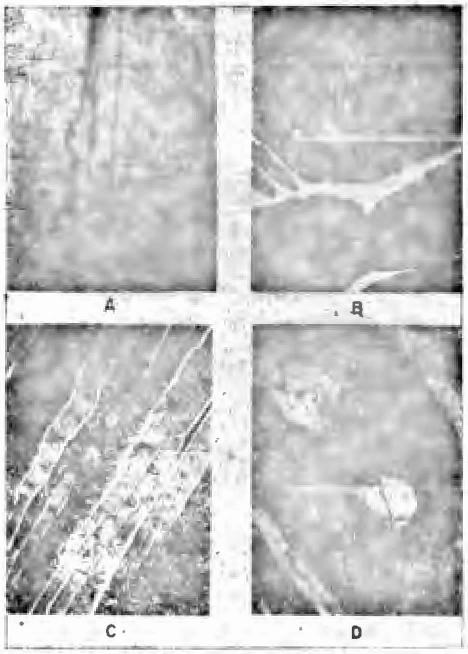

FIG. 2

The Glorieta Mountain, New Mexico, Siderite: A. Lawrencite in kamacite; B. "Comb" structure: kamacite, taenite, and dark plessite; C. Light, elongate plessite interspersed among kamacite and taenite lamellae; D. Schreibersite in equant, euhedral crystals; × 40.

lamellae cross each other, and thins away from the intersection. Taenite occurs also in the light plessite in the arrangement referred to by German writers as *Kämme* (combs) (Fig. 2B); furthermore, the taenite bands are thickest at the border of the light-plessite field, and thin towards the center of the field.

Plessite, both the light and the dark variety, is abundantly present in the polished sections, generally filling the angular interstices of the octahedral structure (Figs. 2B & 2C). The light, or normal, variety is the predominant type of plessite. It is found typically in the octahedral structure, but it is found also in elongate fields interspersed among kamacite and taenite lamellae (Fig. 2C). Some dense plessite also was found occupying a similar position. The dense plessite occurs also in rectangular fields bounded by taenite, and as a component of the comb arrangement (Fig. 2B).

Schreibersite is not an abundant constituent, but it occurs as equant, fairly euhedral, tetragonal crystals (Fig. 2D). The greatest number of these schreibersite crystals fall in the range of 0.1 to 0.2 mm. It is to be noted in the chemical analysis (Table 1) that an extremely small percentage of phosphorus is indicated, much smaller than the microscopic examination would indicate; evidently the sample taken for chemical analysis failed to include many of the numerous isolated grains of schreibersite.

No troilite was noted in the polished sections, and the chemical analysis (Table 1) confirms the absence of sulfur.

Chemical Analysis

A chemical analysis of a representative sample of the Glorieta Mountain siderite was made by Dr. E. L. Martin, Department of Chemistry University of New Mexico. The results are shown in Table 1.

Table 1
Chemical Analysis of the Glorieta Mountain Siderite

Fe	88.37%
Ni	10.39
Co	0.84
Cl	0.48
Cu	0.00
S	0.00
P	0.001
Total	100.081%

$$\text{Molecular Ratio } \frac{Fe}{Ni} = 8.96$$

$$\text{Molecular Ratio } \frac{Fe}{Ni + Co} = 8.29$$

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Notice of the 14th Meeting of the Society

The Council of the Meteoritical Society announces that the 14th Meeting of the Society will be held in conjunction with the next annual meeting of the Pacific Division of the American Association for the Advancement of Science, on Monday, Tuesday, and Wednesday, June 18-20, 1951, at the University of Southern California, Los Angeles 7, California. The Society shares invitations with the Astronomical Society of the Pacific, which will meet at the same time and place, to visit the Griffith Observatory on Monday evening, June 18, and the Mount Wilson Observatory on Wednesday afternoon, June 20.

Members of the Society are hereby requested to send the undersigned, at their earliest convenience, the titles and abstracts (the latter in form for publication in *C.M.S.*) of any papers that they may wish to present, or to have presented, at the forthcoming meeting.

John A. Russell, *Secretary*