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THE "TICRACO CREEK" SIDERITE.

By

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(Plates ii-iv, and Figure 1.)

While Mr. J. F. Connelly was prospecting in the vicinity of Mount Padbury, Western Australia, on the North Murchison Gold Field, during August 1922, he learnt from a small party of miners that a meteorite had been found and had been taken to town. After a number of inquiries as to its whereabouts he finally traced it to a rubbish tip at Meekatharra. It had been dumped here by the original finders, who had discovered it near the head of Ticraco Creek, North Murchison Gold Field (Lat. 26° 20′ South, Long. 118° 20′ East), at a height of 2,000 feet above sea level, on the surface of the ground. Neither the name of the discoverer nor the date of finding is known.

The weight of the meteorite is 4173.5 grams and the specific gravity of the whole, including the weathered crust, is 7.59. These determinations were made by Mr. A. J. Christie, Superintendent, Royal Mint, Sydney Branch.

The meteorite, apparently, had remained partially buried for some considerable time, as half had been more or less protected from the action of weathering while the other half had a thick coating of iron oxide. Naturally etched Widmanstätten figures are very conspicuous, and in one place some of the plates of nickel-iron alloys have been removed by weathering, showing the internal structure in relief. (Plate iv, fig. 3). "Thumb-marks" are well developed; two of these depressions on opposite sides meet to form a hole practically through the centre. In addition to the thumb-marks the whole surface is pitted, while there are a number of "drill-holes" measuring from 20 to 30 mm. in diameter with a maximum depth of 50 mm. At one end of the meteorite one of these drill-holes has completely pierced it. (Plate iv, fig. 1).

Though the usual theory in regard to "thumb-marks," is that they have formed during the passage of the meteorite through the atmosphere, may be true, it does not seem to account for the origin of the "drill-holes." It is therefore suggested that these have been formed, after the meteorite has come to rest, by the action of weathering on such a mineral as troilite.

The polished surface of the cut meteorite (Plate ii) was etched with very dilute nitric acid. In the etching two interesting features were noted. Firstly one end was more easily etched than the other, and, secondly, the Widmanstätten figures were more closely spaced in this portion. This is possibly due to a slight variation in chemical composition. N. T. Belaiew[1] states that a very high temperature of the mass below the temperature of fusion results in large granulation and then a relatively rapid cooling, which results in a quick separation of kamacite and taenite. There is no reason to believe that different temperatures affected the two ends of this meteorite, nor that the rate of cooling was different, and thus these two factors could not be responsible for the variation in etching.

The etched surface shows a considerable amount of included minerals of which troilite and schreibersite have been determined. One of the nodules (Plate iv, fig. 2) has what appears to be a crystal of schreibersite penetrating the troilite, which is again partially surrounded by schreibersite.

One hundred measurements of the thickness of the plates gave an average of 4.08 mm., so that the siderite belongs to the fine octahedrite (*of*) of Brezina's classification.

Slices of the meteorite for analysis were cut with an ordinary engineer's hacksaw. It was noticed that when the meteorite was cold cutting was more difficult than when warm, indicating that the hardness decreases with an increase of temperature.

The analysis was made by one of the writers (H.P.W.) with the following result :—

Iron	89.056
Nickel	9.660
Cobalt	0.720
Copper	trace (less than 0.0005)
Chromium	trace (less than 0.0005)
Phosphorus	0.203
Sulphur	0.143
Chlorine	absent
Carbon	0.008
Silicon	absent
Platinum	0.001
	99.791

The following elements were looked for but not found :—antimony, tin, manganese, titanium, tungsten, vanadium, uranium, molybdenum, gold, zinc, calcium, magnesium. A minute trace of some platinum metal, insoluble in aqua regia, is present, probably iridium or osmiridium.

From the above analysis, assuming the composition of troilite as FeS and schreibersite as Fe_2NiS, the mineral content will be as follows :—

Metallic alloys.—		
Iron	88.171	
Nickel	9.330	
Cobalt	0.720	98.221
Troilite		0.352
Schreibersite		1.208
Platinum		0.001
Carbon		0.008
		99.790

[1]Belaiew—On the genesis of Widmanstätten structure in Meteorites and in iron-nickel and iron-carbon alloys. *Min. Mag.*, XX, 1904, pp. 173-185.

The iron-nickel ratio is 9.4 which brings the meteorite into group 2, class iron of Prior's classification.

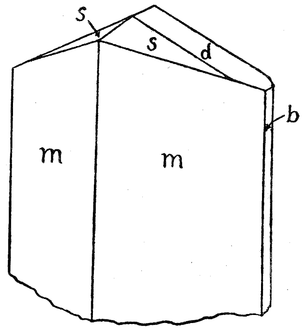


Fig. I. Schreibersite from the "Ticraco Creek" siderite. Forms—b(013), m(110), d(101), and s(177).

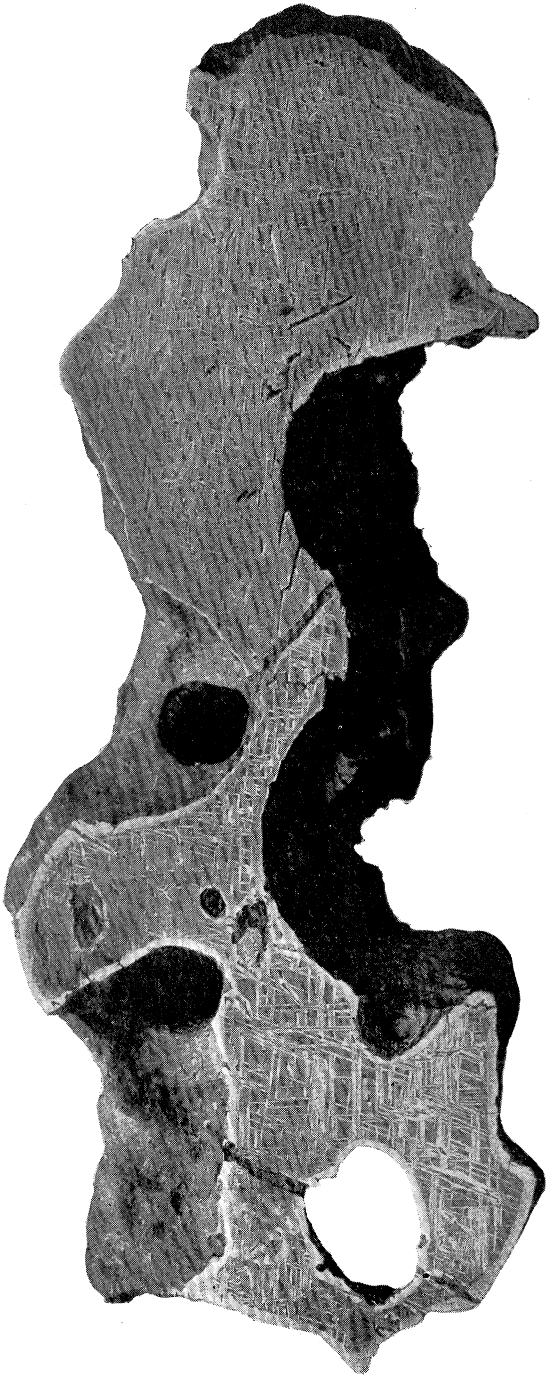
The meteorite dissolves readily in dilute acid leaving a residue varying in amount from 0.16 to 2.36 per cent. This residue consists of small flakes and grains, skeleton crystals and diverging groups of prismatic crystals. The largest individual crystal measures 3 mm. in length. The colour varies from steel grey to dark iron-grey, and the lustre is metallic, brilliant. Specific gravity is 7.01. For the most part the faces are more or less rounded and unsuitable for measurement. Other faces, giving good signals but very large indices, are probably accidental impressions or contact planes resulting from pressure of neighbouring crystals or of the nickel-iron alloy. On one crystal (Fig. 1) giving fairly good signals, the following forms previously recorded for rhabdite, the terrestrial form of schreibersite ($\acute{c} = 0{\cdot}4880$) were recognised :—*b* (010), *m* (110), *d* (101). A new form *s* (177) was represented by two faces giving good signals. The only other pyramid present appeared to be *p*(111) which was very much rounded. Two planes vicinal to this form are present.

The following table gives the φ and ρ angles, measured and calculated :—

Form	Measured				Calculated				Error	
	φ		ρ		φ		ρ		φ	ρ
	°	′	°	′	°	′	°	′	′	′
b(010)	1	06	90	00	0	00	90	00	66	—
m(110)	45	05	90	07	45	00	90	00	05	07
d(101)	89	24	26	03	90	00	26	07	36	04
s(177)	8	07	24	54	8	07	24	32	—	21

EXPLANATION OF PLATE II.

Etched surface of the " Ticraco Creek " siderite, showing variation in Widmanstätten figures, and cylindrical inclusions of troilite. The characteristic " thumb-marks " and " drill-holes " are also shown.



G. C. CLUTTON, photo.

EXPLANATION OF PLATE III.

"Ticraco Creek" siderite showing the external characters and the hole through the middle.

G. C. CLUTTON, photo.

Explanation of Plate IV.

"Ticraco Creek" siderite.

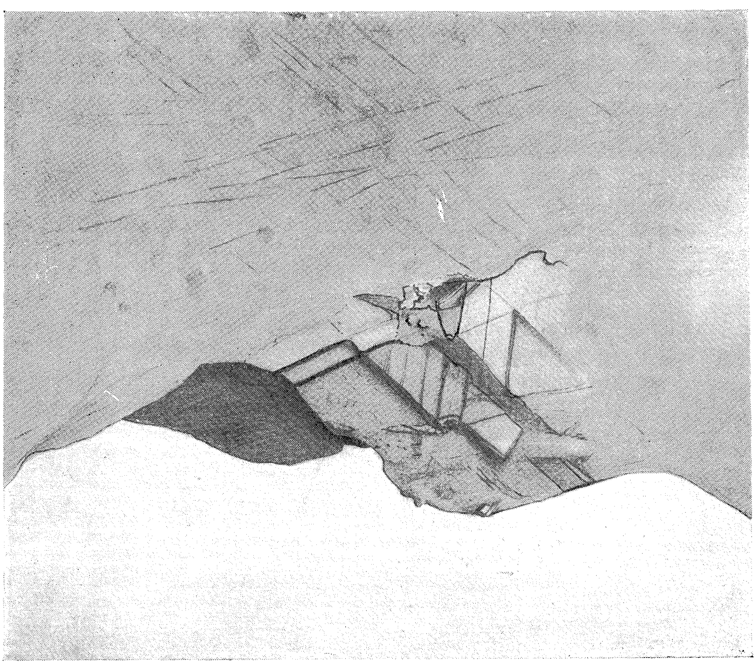
Fig. 1. End view, showing a "drill-hole" which has pierced the meteorite.

,, 2. A crystal of schreibersite included in troilite which is again partially surrounded by schreibersite.

,, 3. Portion showing the effect of weathering in bringing out the internal structure in relief.

1

2



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G. C. CLUTTON, photo. (1-2).
G. P. WHITLEY, del. (3).