A new siderolite from Bencubbin, Western Australia.

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IN July 1930 a fragment of this meteorite was received at the Government Laboratory, Perth, with a request from the sender that he should be informed of its nature and value. Realizing its scientific interest, one of the authors (E. S. S.) took advantage of a visit to Bencubbin (lat. 30° 48′ S., long. 117° 51′ E.; about 150 miles NE. of Perth in the South-West Division) to interview the finder and suggest that the whole mass should be handed over to the Government Laboratory for examination, a specimen detached for the British Museum, and the main mass finally presented to the Western Australian Museum in Perth. This arrangement was agreed to.

The mass was found in 1930 almost completely buried in some newly cleared ground on Holland and Breakells wheat farm (Block 2557) situated 12 miles NW. of Bencubbin. The broad base was found projecting to the extent of only two to three inches above the soil.

It is a single complete body weighing 119·5 lb. (54 kg.) and having roughly the form of a square-based frustrum. Its dimensions are 12 × 8 inches (30 × 20 cm.) on the base, 7 × 5 inches (18 × 13 cm.) on the top, and 9 inches (23 cm.) deep. The whole of the surface is covered by the usual thin oxidized crust. It is not deeply thumb-marked over the greater part of the surface, but there are two deep grooves close to one another, one 4 inches long by 1·5 inch deep (10 × 4 cm.), the other 3 inches long and 1· inch deep (8 × 3 cm.). One of these grooves, as well as the general outward appearance of the meteorite, is illustrated in figs. 1 and 2.

When an attempt was made to break off part of the meteorite for distribution and analysis, it was found to be very tough owing to the skeleton of nickel-iron. A fresh fracture is rough and hackly, with a background of greyish to brownish-black colour, through which are rather regularly distributed a number of masses of a greyish-white silicate. The latter has a density of 3·15 to 3·17 and proves to be enstatite. Each of these masses appears to be composed of a single crystal (often multiply twinned), though sometimes two may

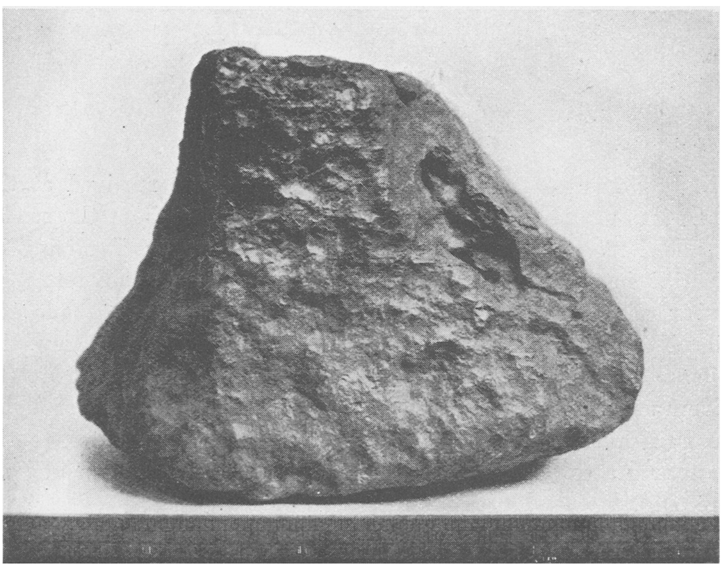

FIG. 1. The Bencubbin meteorite (obverse). Photograph by B. L. Southern. × 4/15.

be in conjunction. They have subangular to angular outlines, and are usually 5 to 10 mm. (0·2 to 0·4 inch) in diameter. In one place only, a group of small (1 mm. or less) rounded pale grey chondrules are visible. Only very rarely is a fresh metallic fracture seen, the meteorite tending to rupture along the surfaces of the metallic masses, which have a thin rusty surface throughout.

By polishing and etching a surface about 1·5 × 1·2 inches (4 × 3 cm.) the metallic component appears in rounded to angular masses up to 1 cm. in diameter. Etching does not reveal any Widmanstätten figures, but brings out a slight blotchiness in the lustre, and resolves most of the largest masses into somewhat smaller individuals separated by a minute film of rust. Between the larger areas are much smaller threads and specks of metal, representing the cross-sections of coral-like outgrowths from the main masses.

This polishing and etching reveals the dark olive-coloured olivine in crystal individuals of the same size as the enstatite. They are completely obscured by rust on the roughly fractured surfaces.

The anorthite indicated by the analysis could not be detected

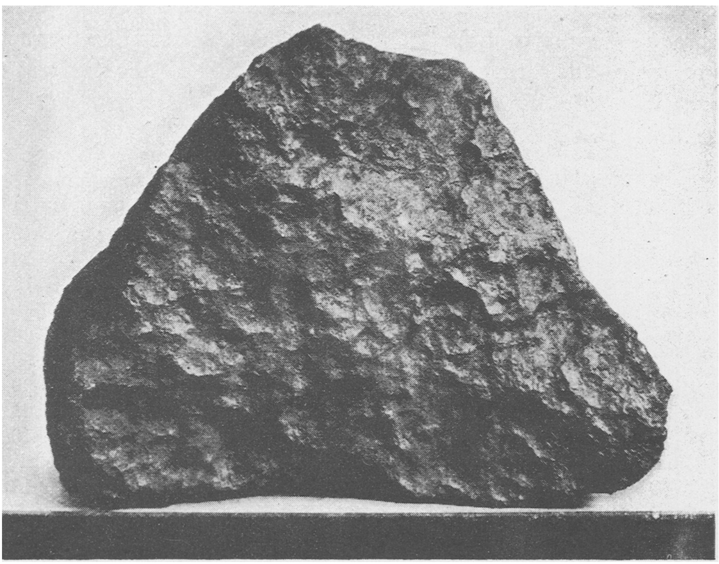

FIG. 2. The Bencubbin meteorite (reverse).
Photograph by B. L. Southern. × 4/15.

macroscopically, and attempts to make a transparent section for examination under the microscope failed, owing to the very coarse grain and the peculiar constitution and state of oxidation of the meteorite.

During the etching the odour of hydrogen sulphide revealed the presence of troilite.

A number of chips of the inner portion of the meteorite weighing in all 30 grams were pounded well in a diamond mortar and sifted, the more metallic portions being further hammered to separate as far as possible the brittle silicates. The broken material thus obtained was separated with a magnet into a magnetic and non-magnetic portion, the finest portions being ground in alcohol and re-separated by a magnet. The fractions obtained by this treatment were:

Metallics over 10 mesh	46·0 %
,, ,, 30 ,, ...	12·2
,, ,, 90 ,, ...	5·9
,, under 90 ,, ...	6·1
Non-metallic residue	29·8
	100·0

Subsequent analysis of the two fractions, magnetic and non-magnetic, showed that the former still retained about 2 % of silicates, and the latter about the same amount of rusted metal. Analyses made by one of us (D. G. M.) yielded the following results:

Magnetic portion.	
Fe*	87·51
Ni	5·78
Co	0·63
S...	0·74
Insoluble	0·75
O, H_2O, sol. SiO_2, and MgO	[4·59]
	100·00

Fe : Ni = 15·1 : 1
MgO : FeO = 8·5± : 1·0
MgO+FeO : CaO = 20·1 : 1·0

Non-magnetic portion.	
SiO_2	47·44
TiO_2	0·19
Cr_2O_3	0·38
Al_2O_3	4·13
Fe_2O_3	1·10
FeO†	7·06
MnO	0·56
MgO	34·99
CaO	2·68
Na_2O	0·10
K_2O	nil
Ni	0·13
Co	0·02
H_2O	2·76
C	trace
	101·54

* Some of this present as ferric hydroxide.
† Approximate, owing to presence of metallic iron and carbon.

The calculated mineral compositions of the two fractions and of the whole meteorite, omitting the water of hydration, are approximately:

	Metallic.	Non-metallic.	Whole. Weight %	Vol. %
Nickel-iron ...	98·0	—	68·8	47·8
Troilite	2·0	—	1·4	1·6
Enstatite ...	—	45·3	13·5	23·1
Olivine	—	42·0	12·5	20·2
Anorthite ...	—	12·1	3·6	7·1
Chromite... ...	—	0·6	0·2	0·2
	100·0	100·0	100·0	100·0

Calculated specific gravity 5·42

The specific gravities of five separate fragments ranging from 90 to 250 grams were 5·16, 5·21, 5·24, 5·38, and 5·67. The weighted mean of these is 5·32. This agrees closely with the figure calculated from the analysis in which no allowance was made for the known hydration. It was from these five fragments that the material for the analysis was taken. The specific gravity of the 10 lb. (4533 grams) fragment reserved for the British Museum was slightly less, namely 5·14. Assuming that the other constituents are present in the same relative proportions as in the analysed portion, this represents a content of about 64 % of nickel-iron, the weighted mean specific gravity of the other components being calculated to be 3·23. The highest recorded gravity, 5·67, indicates 74 % of nickel-iron. The distribution of the metal is therefore somewhat uneven, as one would expect in such a coarse-grained mixture.

The Bencubbin meteorite does not closely resemble any other siderolite of which details could be found in the available literature. According to the classification of A. Brezina, as elaborated by G. T. Prior,[1] it would be classed as a mesosiderite, characterized by the presence of hypersthene (or enstatite), olivine, and plagioclase with nickel-iron and troilite, the ratio of nickel to iron being low. The proportion of nickel-iron is much higher than is usual in this group.

[1] G. T. Prior, Min. Mag., 1916, vol. 18, p. 26; 1920, vol. 19, p. 51.