A new pallasite from Alice Springs, Central Australia.

(With Plate IV.)

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DR. Herbert Basedow of Adelaide generously presented in November 1931 for the British Museum collection of meteorites a pallasite which he had collected in Central Australia in 1924 while leading the Vice-Regal Expedition. During his extensive explorations in Central and Northern Australia it had remained unpacked for some years. He gives the locality as on the Burt Plains, NNE. of Bond Springs in the Alice Springs district; lat. 23° 33′ S., long. 133° 52′ E. This is immediately north of the MacDonnell Ranges and about ten miles north of Alice Springs. The fragment was found lying on the surface and only partly buried in loose ferruginous sand. No doubt other pieces of this material remain to be found in the district.

This locality is about 80 miles NE. of the Henbury meteorite craters (this vol., p. 19) on the south side of the MacDonnell Ranges, but the meteorites from the two places are of quite distinct types. After the thrill of unpacking Mr. R. Bedford's wonderful collection of 542 masses of the Henbury meteoric iron it was a remarkable coincidence that Dr. Basedow should call at the Museum on the very next day with this interesting specimen from the north side of the MacDonnell Ranges. This arid region is evidently especially suitable for the preservation of meteorites that have fallen during past ages.

The specimen is an irregular slabby piece measuring about $11 \times 8 \times 3$ cm. and as received it weighed $1084\frac{1}{2}$ grams. By facing and polishing one surface the weight has been reduced to 1036 grams. The surface shows hackly metal and some flat cleavage planes up to 1 cm. across of brown olivine, with only a small amount of iron rust. During the preparation of the polished surface by Mr. T. F. Vincent it was noted that the metal was unusually hard to the file. The Henbury iron yielded much more readily.

The polished surface (Plate IV, fig. 2) shows an irregular distribution of nickel-iron and olivine, both of which are present in large amount. The olivine is rather friable, and during the filing it broke out from the surface in the larger areas. Brecciated fragments of olivine, often of minute size, are seen scattered through the iron. An exact measurement of the actual areas occupied by metal and olivine was therefore not attempted. But a series of linear measurements with a millimetre scale gave as a mean result nickel-iron 42 % and olivine 58 % (by volume). The polished surface also shows (but not distinguishable in the photograph) a number of small irregular patches of pale bronze-coloured troilite, which are in most cases situated at the junction of the metal and the olivine, but sometimes as small veins in the kamacite.

Even before etching, the polished surface of the metal shows indications of a coarse granular texture. This is brought out distinctly by etching for a few minutes with very dilute nitric acid. Grains of kamacite up to ½ cm. across have smaller angular areas of plessite in the interspaces, and between the two there is a bright narrow band of taenite (Plate IV, fig. 3). Small angular fragments of olivine are embedded in the kamacite, suggesting that the olivine had been broken up before the kamacite crystallized out. The granular texture of the metal also suggests that the kamacite had been broken up before the separation of the taenite and plessite, and that the fragments had been partly redissolved in the residual melt giving the reaction-rim of taenite. Finally, the plessite eutectic separated out in the interspaces.

Under the microscope, the kamacite shows well-marked Neumann lines in several directions. Kamacite and taenite show a sharp line of separation, and the Neumann lines do not extend into the taenite. Possibly these Neumann lines were developed at the time when the kamacite was broken up. The plessite shows a very fine Widmannstätten structure, and its feathery edges extend into the taenite, there being no sharp line of demarcation between the two.

The specific gravity of the whole mass (1036·125 grams) was determined by hydrostatic weighing as 5·16; that of the lumps of olivine broken out of the cavities as 3·41; and that of the metal filings separated with a magnet as 7·87. Calculated from these figures the amounts of olivine and nickel-iron are:

	Weight %	Volume %
Olivine	40·2	60·8
Nickel-iron	59·8	39·2

This agrees with the estimate obtained above by linear measurement. Quite different figures were, however, obtained by a magnetic separation of the powder saved when filing down the surface, namely for the attracted portion 70 % and for the unattracted portion 30 % (by weight); but this is no doubt accounted for by the loss of some olivine as dust, and, further, some of the olivine is attracted owing to the presence of magnetite.

The olivine in mass is dark brown in colour. Thin splinters under the microscope are almost colourless and quite fresh, but stained with brown iron hydroxide and black oxide along crevices. The following optical data for the olivine have been obtained by Mr. M. H. Hey: α 1·667, β 1·684, γ 1·701, 2V about 90°.

Chemical analyses have been made by Mr. M. H. Hey of the small lumps of olivine and of the filings attracted by a magnet, with the following results:

Olivine.		Nickel-iron alloy.[1]	
SiO_2	37·24	Fe	92·28
TiO_2	nil	Ni	7·27
FeO	16·92	Co	0·20
MgO	43·88	S	0·21
CaO	1·26	P	nil
	99·30		99·96
Sp. gr.	3·41	Sp. gr.	7·87
MgO : FeO (mol.) ...	4·6	Fe : Ni (wt. %) ...	12·7

The bulk composition of the meteorite calculated from these figures and the proportions of olivine (40·2 %) and nickel-iron (59·8 %) is:

Fe.	Ni.	Co.	S.	SiO_2.	FeO.	MgO.	CaO.	Total.
55·35	4·36	0·12	0·13	15·02	6·82	17·69	0·51	100·00

This result compares closely with the composition of the Brahin (Russia) and Brenham (Kansas) pallasites given by P. N. Chirvinsky[2]

[1] The analysis of the nickel-iron was made by the chlorine distillation method described on pp. 13, 48 of this volume.

[2] P. N. Chirvinsky, Pallasites. Bull. Don Polytech. Inst. Novocherkassk, 1918, vol. 6, sect. 2, supplement, 19 pp. (Russian). [Min. Abstr., vol. 2, pp. 83–84.]

in a table of calculated bulk compositions of seventeen pallasites. In his table pallasites are arranged in order of the percentage of olivine, ranging from 37·18 % in Brahin to 75·11 % in Mount Dyrring (New South Wales). Alice Springs therefore lies at the olivine-poorer end of the series of pallasites.

North Australia:

1. Yenberrie, iron, found 1918.
2. Roper River, iron, known before 1927.

Central Australia:

3. Alice Springs, pallasite, found 1924.
4. Henbury, iron, found 1931.
5. Arltunga, iron, found about 1908.
6. Artracoona, iron ?, known before 1927.
7. Cartoonkana, iron ?, known before 1927.

South Australia:

8. Kingoonya, stone, found about 1927.
9. Yardea, iron, found 1875.
10. Carraweena, iron, found before 1927.
11. Murnpeowie, iron, 2520 lb., found 1909.
12. Weekeroo, iron, found 1924.
13. Rhine Villa, iron, found 1900.
14. Cadell, stone, found 1910.
15. Karoonda, stone, fell Nov. 25, 1930.
16. Glen Osborne ?
17. Accalana ?

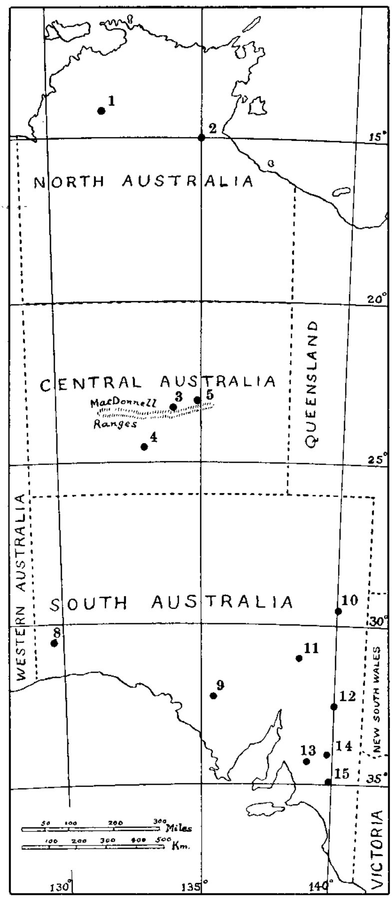

FIG. 1. Sketch-map showing distribution of meteorites in North, Central, and South Australia.

Compared with meteoric stones and irons, the stony-irons or siderolites are the less frequent type of meteorites. Those previously recorded from Australia include: the pallasites 'Australia' (found

1880),[1] Bendock (Victoria, found 1898), Mount Dyrring (New South Wales, found 1903), Molong (New South Wales, found 1912); the doubtful stony-iron of Kulnine (New South Wales, known in 1886); and the mesosiderite of Bencubbin (Western Australia, found 1930).[2]

The accompanying sketch-map (fig. 1) shows the distribution of the meteorites so far known from South Australia, including Northern Territory (North and Central Australia). Several of them are in the South Australian Museum at Adelaide and have not yet been described, and it has not been possible to locate some of these on the map. Of the seventeen listed only one has been observed to fall.

EXPLANATION OF PLATE IV.

Pallasite from Alice Springs, Central Australia.

(Photographs by H. G. Herring.)

FIG. 2. Polished (not etched) surface, showing nickel-iron (white) and olivine (black). Actual size.

FIG. 3. Etched surface, showing the bright band of taenite between the grains of kamacite (white) and the angular areas of plessite (grey). Olivine fragments (black) in the kamacite. In this position (to show the taenite) the Neumann lines in the kamacite are less prominent. The area enlarged is outlined in fig. 2. ×9.

[1] 'Australia' is discredited in G. T. Prior's British Museum Catalogue of Meteorites, Appendix, 1927, p. 9; but it appears in C. Palache's Catalogue of the Harvard Collection of Meteorites, Proc. Amer. Acad. Arts & Sci., 1926, vol. 61, no. 6, p. 152. [Min. Abstr., vol. 3, p. 252.]

[2] E. S. Simpson and D. G. Murray, this vol., p. 33.

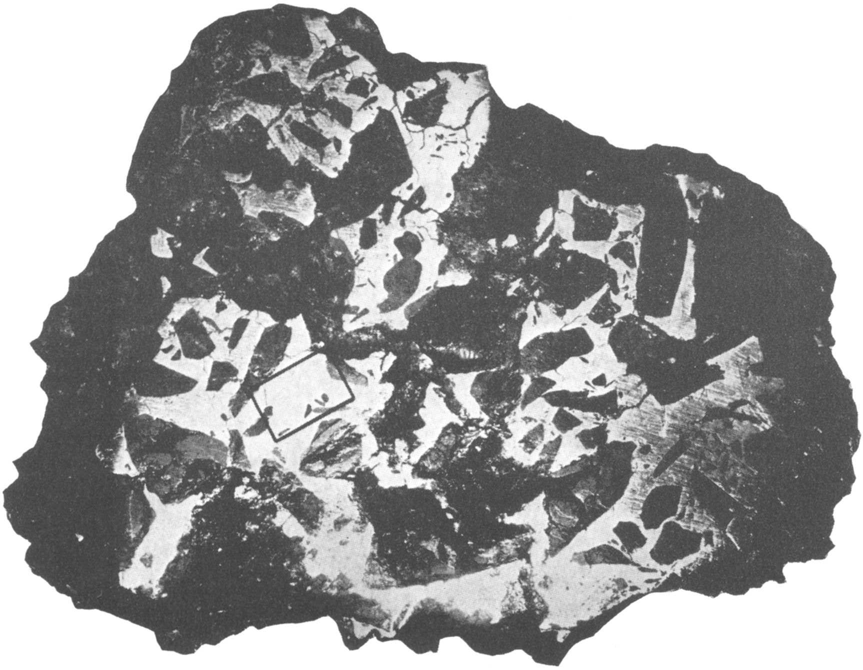

FIG. 2.

FIG. 3.

L. J. SPENCER: PALLASITE FROM ALICE SPRINGS, CENTRAL AUSTRALIA.