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8.—A review of meteorite finds on the Nullarbor Plain, Western Australia, including a description of thirteen new finds of stony meteorites

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Manuscript received 21 April 1970; accepted 21 May 1970.

Abstract

The record of 36 finds of meteorites on the Nullarbor Plain (all but two within the last two decades) is brought up to date, and the thirteen most recent finds are described in detail; all the recent finds are common chondrites. The most unusual is the Coorara stone, which contains within narrow shock-produced veinlets the garnet-structured mineral majorite (isochemical with pyroxene) and the spinel-structured mineral ringwoodite (isochemical with olivine). These two minerals were previously recorded in nature only from specimens of the Tenham, Queensland stony meteorite shower. Other unusual stones are the Reid meteorite, a rare, primitive unequilibrated chondrite: the North Reid meteorite, an amphoterite: and the West Reid meteorite, a chondrite with the chondrules virtually obliterated by recrystallisation (as in the unique Shaw meteorite), and displaying anomalous olivine, Fa_{21}, lying in the gap between the values for the two groups of common chondrites (CBr, CHy). The implications of recovery statistics are briefly considered.

Introduction

Thirteen new finds, mostly made by rabbit trappers, of stony meteorites from the arid Nullarbor Plain, a limestone desert (McCall and Cleverly 1968), are described below, augmenting the list already given by the authors (1968, 1969) and McCall and de Laeter (1965, 1968). The new finds are:— Coorara, Forrest, Gunnadorah, Laundry East, Laundry Rockhole, Laundry West, North East Reid, North Forrest, North Reid, Oak, Reid, Webb and West Reid.

Details of find locations are given in Fig. 1, in which all the 36 finds to date on the Nullarbor Plain in Western Australia are recorded (there are no recorded falls). The sites of the last seven meteorites listed above are approximate, being as reported by the finders, but all of the other 29 sites have been visited by one of us (W.H.C.), and they are probably correct to about one minute of latitude and longitude. The statistics of finds for this, the most productive area in Australia and one of the most productive in the world, are given in Table 1.

Details of the thirteen new finds

To avoid breaking the text excessively, photograph numbers have been omitted. The accompanying photographs show the main masses of any meteorite which has some interesting physical feature; photomicrographs of all the meteorites are given.

Coorara.—Find, 1966, by A. J. Carlisle, approximately 0.4 miles south of the site of the Dingo Pup Donga ureilite recovery (Fig. 2D) (vid. McCall & Cleverly 1968), a broken mass weighing 92.4g; also eight small fragments totalling 24.3g found 0.2 mile north-west of the Dingo Pup Donga site. It is weathered, brown, brecciated meteorite, traversed by dark veins and partly covered by a brown fusion crust. Thin section examination shows it to be recrystallised, but poorly defined chondrules are preserved. Olivine, orthopyroxene and oligoclase are evident. There are some unusual areas of felspar inset with decussate laths of a brown, altered ferromagnesian mineral (olivine?), and also veinlets of a black glass inset with a purple isotropic mineral. First thought to be entirely garnet (Mason, Nelen and White 1968), it is now known that these veins contain both a purplish spinel and a garnet. These have been identified by J. V. Smith as ringwoodite $(Mg,Fe)_2 SiO_4$, a spinel-structured polymorph of olivine, and majorite $Mg_3(MgSi) Si_3O_{12}$, a garnet-structured polymorph of orthopyroxene ($Mg Si O_3$). These phases had previously been predicted as possible components of the high pressure intermediate zone of the terrestrial mantle, but had been found in nature only in stones of the Tenham, Queensland meteorite shower (Binns 1969: Binns, Davis and Reed 1969). The garnet is very fine grained and difficult to detect, even under high magnification. This information is based on a written communication from Dr. B. Mason, Smithsonian Institution, Washington, D.C., U.S.A.

The meteorite is an olivine-hypersthene chondrite (olivine, Fa_{25}) of type 5 of van Schmus and Wood (1967). The specific gravity is 3.27. The main mass of 72.4 grams is held in the Western Australian Museum (W.A.M. No. 13013); there is also a 3 gram slice (W.A.M. No. 12941) and some small chips weighing 4.5 grams (W.A.M. No. 12023). Chips from the north-western occurrence totalling 11.5 grams are held in the School of Mines, Kalgoorlie collection (No. 10150).

Forrest.—Find, October-November 1967, by A. J. Carlisle, 6 to 7 miles east-north-east of Forrest station on the Trans-Australian Railway line; a single, highly weathered mass with a small remnant area of fusion crust, weighing 97.7 grams. The interior is highly oxidised. In thin section the meteorite is seen to be highly recrystallised and to contain an angular, fine textured enclave of unusual character. The host material is highly brecciated and oxidised, but reveals broken chondrules. There is a trace of oligoclase in the form of minute, clear grains.

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Lamellar twinned clinohypersthene and glass were not recognised. The enclave is sharply bounded and faceted. It consists of minute, irregular olivine crystals set in a very fine, turbid silicate base. A few opaque mineral specks are set within the enclave, but it contains less nickel-iron than the host material. The exact nature of the enclave remains uncertain. The meteorite is an olivine-bronzite chondrite (olivine, Fa_{19}), of the mineralogical and textural type 6 of van Schmus and Wood (1967). Its specific gravity is low—3.29—reflecting the oxidised state of the mass. The main mass is held in the collection of the School of Mines, Kalgoorlie (No. 10297), and the meteorite is also represented in the collection of the Western Australian Museum by a small chip (W.A.M. No. 13022) weighing 2.5 grams and a thin section (W.A.M. No. 12940).

Gunnadorah.—Find, June 1968, by M. K. Quartermaine, 168 yards on a bearing of 08° from the 837 mile post on the Trans-Australian Railway line, between Rawlinna and Haig stations, and close to the boundary of Gunnadorah pastoral station. The find was of a single small fragment of weathered material weighing only 19.7 grams. Microscopic examination reveals a spherical chondrite, considerably recrystallised. Lamellar clinohypersthene is evident, but not plagioclase. There is an enclave of fine material of uncertain character. There is much evidence of microbrecciation, the mass being traversed by cracks filled with limonite and carbonate of terrestrial origin. The chondrules are in many cases broken, and are of complex internal structure and small diameter. The meteorite is an olivine-bronzite chondrite (olivine, Fa_{18}), of type 4 of van Schmus and Wood (1967), with glass present. The specific gravity was not determined in view of the meagre recovery and its weathered state. The main mass is held at the School of Mines, Kalgoorlie (No. 10307). A small chip and thin section are held in the collection of the Western Australian Museum (W.A.M. No. 13019).

TABLE 1

Meteorite finds on the Nullarbor Plain, Western Australia

No.	Name	Type, Fayalite index	Finder	Date	Latitude S.	Longitude E.	Weight	Refs.
1	Billygoat Donga	CHy 25	T. and P. Dimer	1962	30° 08′	126° 22′	142 g	A, B, C
2	Burnabbie	CBr 18	A. J. Carlisle Jnr.	1965	32° 03′	126′ 10°	2·51 kg	B, C
3	Burrika	CHy 24	A. J. Carlisle	1966	31° 58′	125° 50′	20·4 g	B, C
4	Cardanumbi	CHy 24	D. A. Carlisle	1966	32° 10′	125° 38′	6·4 g	B, C
5	Cocklebiddy	CBr 18	A. J. Carlisle	1949	31° 56′	126° 13′	19·5 kg	A, B
6	*Coorara*	CHy 25	A. J. Carlisle	1966	30° 27′	126° 06′	116·7 g	D
7	Dingo Pup Donga	U 10	A. J. Carlisle	1965	30° 26′	126° 06′	122·7 g	B, C
8	*Forrest*	CBr 19	A. J. Carlisle	1967	30° 49′	128° 13′	97·7 g	D
9	*Gunnadorah*	CBr 18	M. K. Quartermaine	1968	31° 00′	125° 56′	19·7 g	D
10	Haig	Om	A. J. and H. E. Carlisle	1951	31° 23′	125° 38′	503 kg	A, B, F
11	*Laundry East*	CBr 19	A. J. Carlisle	1967	31° 31′	127° 08′	43·1 g	D
12	*Laundry Rockhole*	CBr 19	M. K. Quartermaine	1967	31° 32′	127° 01′	1·44 kg	D
13	*Laundry West*	CHy 25	M. and A. J. Carlisle	1967	31° 28′	126° 56′	201·9 g	D
14	Loongana Station[1]	Om	Mr. Harrison (?)	(?) 1962	30° 47′	127° 33′	108 g	A
15	Loongana Station West[1]	Om	W. H. Butler	1967	30° 57′	126° 58′	66·5 g	
16	Mulga (North)	CBr 18	W. H. Cleverly	1964	30° 11′	126° 22′	3·08 kg	B, C
17	Mulga (South)	CBr 18	W. H. Cleverly	1963	30° 12′	126° 22′	298·1 g	B, C
18	Mundrabilla	Om	W. A. Crowle	1965	30° 45′	127° 30′	177·9 g	B
	,,	Om	R. B. Wilson and A. M. Cooney[3]	1966	30° 47′	127° 33′	c. 16000 kg	B
19	Nallah	CBr	A. J. Carlisle	1968	31° 58′	126° 15′	4·617 g	E
20	Naretha	CHy 25	J. Darbyshire	1915	31° 00′	124° 50′	2·3 kg	A
21	North Haig	U O–30	R. F. Kilgallon	1961	30° 13′	126° 13′	973 g	A, B, C
22	*North Forrest*[2]	CHy 24	Unknown	1969	30° 30′	128° 06′	608·9 g	D
23	*North Reid*[2]	CHy 28	D. A. Carlisle	1969	30° 08′	128° 38′	308·7 g	D
24	*Oak*[2]	CHy 25	D. A. Carlisle	1968	31° 35′	127° 42′	75·3 g	D
25	Pannikin	CHy 24	A. J. Carlisle	1965	32° 02′·5	126° 11′	13·6 g	B, C
26	Premier Downs I, II[1]	Om	H. Kent	1911	30° 57′	127° 15′	228 g	A
	,, ,, III[1]	Om	Unknown	1918	30° 57′	to 22′	99 g	A
27	Rawlinna	CBr 20	C. A. Carlisle	pre-1952	Vicinity of Rawlinna		107 g	A, B, C
	,,	CBr 20	A. J. Carlisle	pre-1959	30° 22′	126° 05′	136 g	A, B, C
28	Rawlinna (pallasite)	P	A. J. Carlisle	pre-1959	31° 10′	125° 16′	c·50 g	B
29	*Reid*[2]	variable	D. A. Carlisle	1969	30° 11′	128° 41′	144·1 g	D
30	River	CHy 25	D. A. Carlisle	1965	30° 22′	126° 01′	190·5 g	B, C
31	Sleeper Camp	CHy 25	H. E. Carlisle	1962	30° 15′	126° 20′	1·25 kg	A, B, C
32	*Webb*[2]	CHy 23	E. J. Hockley	1968	31° 41′·5	127° 47′	410·5 g	D
33	Yayjinna	CHy 25	A. J. Carlisle Jnr.	1965	32° 02′	126° 10′·5	262·4 g	B, C
34	Un-named	Oxidised iron	D. A. and A. J. Carlisle	1966	30° 29′	126° 15′	39·5 g	
35	*North East Reid*[2]	CHy 24	D. A. Carlisle	1969	30° 09′	128° 43′	38·6 g	D
36	*West Reid*[2]	CBr 21	N. R. Carlisle	1969	30° 11′	128° 40′	627·7 g	D

Footnotes to Table 1

[1] Nos. 14, 15 and 26 are small masses which were probably shed from No. 18 during atmospheric flight.

[2] The localities of Nos. 22, 23, 24, 29, 32, 35 and 36 have not been visited by the writers and are approximate only.

[3] Re-discovered : rabbit trappers (including a Mr. Harrison) reported these masses a few years before.

Notes on Table 1

The number in the first column identifies the site on Fig. 1. The weight given is the total known weight. The letters in the last column refer to the following references, which are given in full at the end of this paper :—

A—McCall and de Laeter (1965).
B—McCall (1968).
C—McCall and Cleverly (1968).
D—This paper (italicised entries).
E—McCall and Cleverly (1969).
F—Cleverly (1968).

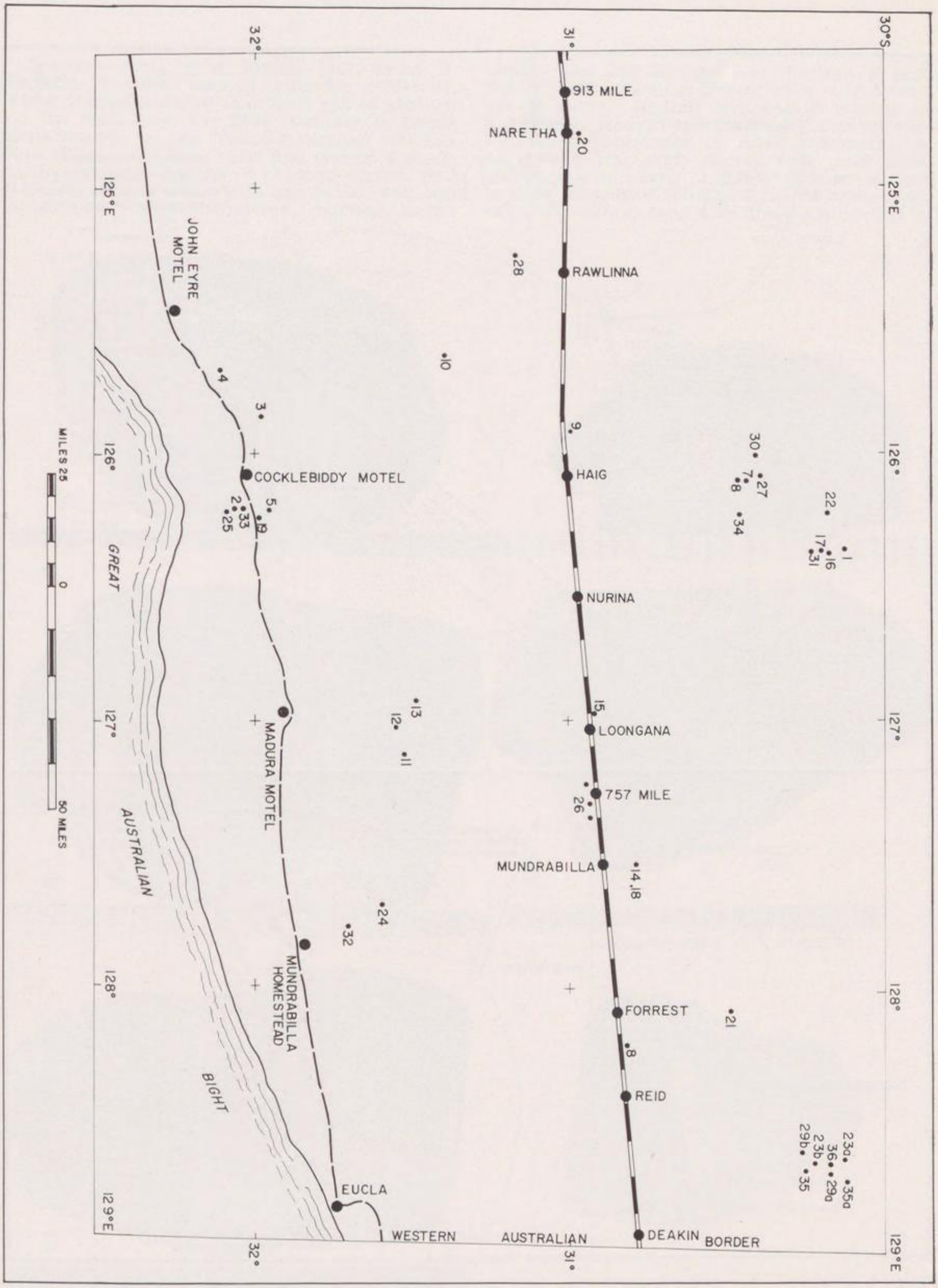


Figure 1.—Map of the Nullarbor Plain in Western Austr alia showing the locations of 36 meteorite finds relative to the Trans-Australian Railway and the Eyre Highway. The meteorite numbers are those used in Table 1, except that the No. 8 north of Haig should read 6, and Nos. 21 and 22 should be interchanged.

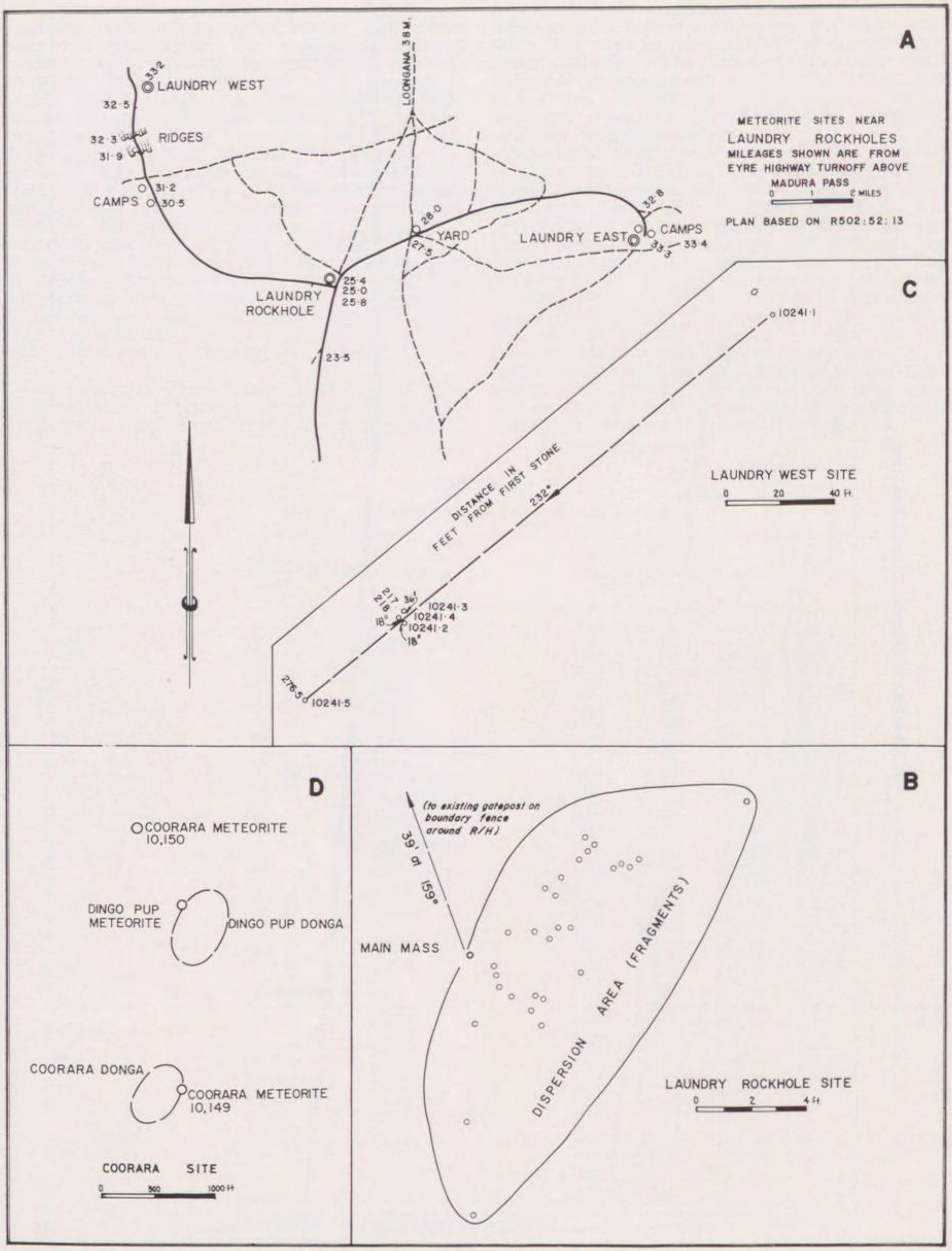


Figure 2.—Diagrams of recovery areas. A.—the three meteorite sites near Laundry Rockhole; B.—the Laundry Rockhole meteorite; C.—the Laundry West Meteorite; D.—the Coorara meteorite.

Laundry East.—Find, March 1967, by A. J. Carlisle, 7 miles east of Laundry Rockhole, which is itself situated 25 miles north of Madura on the road from the Eyre Highway to Loongana Station on the Trans-Australian Railway line (Figs. 1 and 2A). The find was of a single stone, complete but for a chipped corner, and weighing 43.1 grams. It is weathered, and has a smooth, chocolate-coloured, oxidised fusion crust. The cut surface also displays a good deal of oxide staining, indicating a considerable age on earth. In thin section it is seen to be a spherical chondrite, possessing many complex structured chondrules of small dimensions in an opaque, iron-oxide stained base, once probably composed partly of glass. It is an olivine-bronzite chondrite (olivine, Fa_{19}) of mineralogical and textural type 4 in the classification of

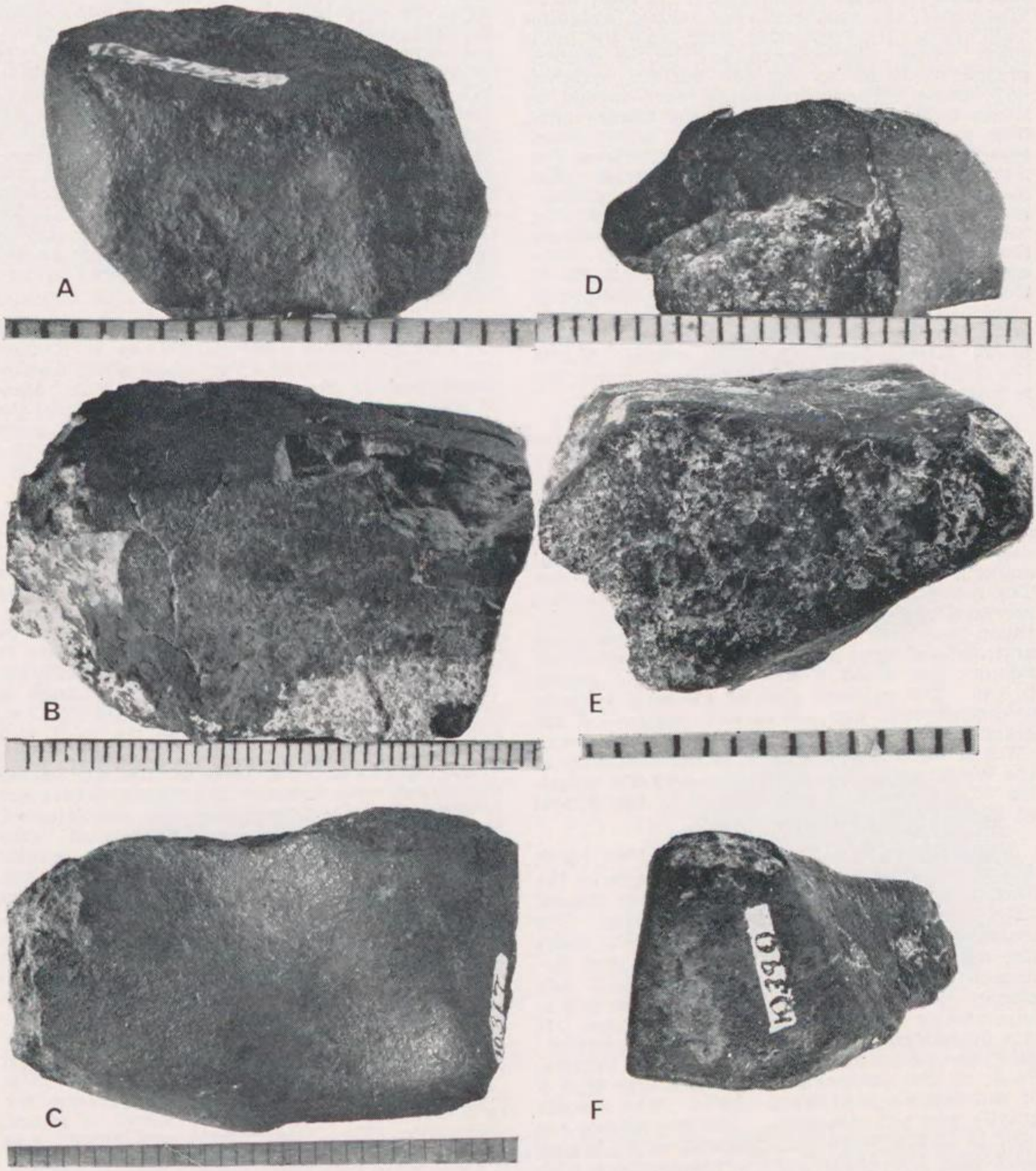


Figure 3.—Photographs of meteorite masses. A.—the Laundry East meteorite; B.—the Laundry Rockhole meteorite; C.—the Webb meteorite; D.—the Coorara meteorite; E. and F.—the Oak meteorite (different views of the same mass) (scale bars are in tenths of an inch).

van Schmus and Wood (1967). The specific gravity is 3.30 (a low value reflecting the oxidation). The main mass is in the Kalgoorlie School of Mines collection (No. 10242) and the meteorite is also represented in the Western Australian Museum collection by a chip and thin section (W.A.M. No. 12937).

Laundry Rockhole.—Find, June 1967, by M. K. Quartermaine near the roadside at the south-east corner of the enclosure fence surrounding the rockhole (Figs 1 and 2A,B). A total of 32 fragments was recovered, the largest weighing 1016 grams; the remainder, shed from the main mass, which had cracked and partly disintegrated while it lay on the surface, weighed 427 grams. These fragments were spread in a semi-circular arc east of the main mass. The mass has a smooth, brown, fusion crust and fine-textured, oxidised interior surface. The form of the mass is that of a half-brick. The microscope reveals a recrystallised olivine-bronzite chondrite (olivine, Fa_{19}) of the mineralogical and textural type 5 in the classification of van Schmus and Wood (1967). The specific gravity is 3.44. The main mass is in the collection of the School of Mines, Kalgoorlie (No. 10243), and the meteorite is also represented in the Western Australian Museum collection by 25 fragments totalling 264 grams (W.A.M. No. 13015) together with two small chips and a thin section (W.A.M. No. 12939).

Laundry West.—Find, March 1967, by Murray and A. J. Carlisle, 6 miles north-west of Laundry Rockhole (Fig. 1 and 2A,C), five angular fragments totalling 201.9 grams, spread out over a linear belt for a distance of 276 feet. The meteorite is strongly oxidised, displaying a smooth, brown, fusion crust and brown, limonite-stained, fresh-cut face, showing a fine texture. The microscope reveals the texture of a highly recrystallised chondrite. It is an olivine-hypersthene chondrite (olivine, Fa_{25}), of mineralogical and textural type 5 in the classification of van Schmus and Wood (1967). The specific gravity is 3.40. The oxidised state of the mass suggests a considerable age on earth. Masses of 120 grams (W.A.M. No. 13011) and 21 grams (W.A.M No. 12938) are held in the collection of the Western Australian Museum, and one weighing 53.6 grams in the collection of the School of Mines, Kalgoorlie (No. 10241).

North East Reid.—Find, September 1969, by D. A. Carlisle, 3 miles north-east of the site of the Reid find (Fig. 1), two small, angular masses weighing 31.1 and 7.5 grams respectively. The mass is highly ferruginised, and appears under the microscope to be highly cracked and deformed. The chondrules are less than 1 mm diameter. Devitrified glass and lamellar clinohypersthene are evident, but no plagioclase. It is a brecciated mass, not significantly recrystallised, an olivine-hypersthene chondrite (olivine, Fa_{24}), of the mineralogical and textural type 4 of van Schmus and Wood (1967). The specific gravity was not measured. The two masses are held in the collection of the School of Mines, Kalgoorlie (No. 10554), and the meteorite is also represented in the Western Australian Museum collection by a thin section (W.A.M. No. 13110).

North Forrest.—Find, some time in 1969, by an unknown person, and passed to A. J. Carlisle. The location of the find was reported to be approximately twenty five miles north of Forrest. The single mass is badly weathered and partly disintegrated, and now comprises three interlocking pieces totalling 608.9 grams. A flat surface covered with pinkish-white caliche is the surface on which the mass must have rested in the ground for a long period. Under the microscope the meteorite is seen to be a brecciated spherical chondrite, the small complex chondrules of which are much deformed. The cracking appears to be primary, but to have been emphasised by the introduction of limonite along the cracks during terrestrial ferruginisation. Turbid glass and lamellar clinohypersthene are evident, but not plagioclase. The meteorite is an olivine-hypersthene chondrite (olivine, Fa_{24})[1], of mineralogical and textural type 4 of van Schmus and Wood (1967). The specific gravity is 3.29. The main mass is held in the collection of the School of Mines, Kalgoorlie (No. 10538) and the meteorite is also represented in the Western Australian Museum by a thin section (W.A.M. No. 13107).

North Reid (I, II and III).—Find, August 1969 (I) and September 1969 (II, III) by D. A. Carlisle. The original find was made about 5 miles north-west of the site of the Reid find. Mass II was recovered 7 miles south-south-west of the site of the Reid find, and mass III six miles south-west of the site of the Reid find. The respective weights are:—

Mass	I	No. 10547	108.3 grams
Mass	II	No. 10553	43.9 grams
Mass	III	No. 10555	156.5 grams

The first find was of an incomplete stone showing orientation characteristics (contrasting rough and smooth fusion crust-coated facets). The second was of a small angular fragment of highly weathered material. The third mass is very similar to Mass I in showing orientation characteristics. The cut face of this mass is orange coloured and shows very sparse flecks of metal together with chondrules up to 2 mm diameter. Sectioning of Mass III revealed chondrules merging into the crystalline matrix; barred chondrules with complex internal structure are prominent. Clinohypersthene was not detected, but oligoclase is evident, aggregated with opaque minerals in the form of minute, mostly untwinned grains. Mass II is more weathered, but otherwise similar. The felspar is in part lamellar twinned in this mass, having a composition of oligoclase ($An_{\sim 25}$). Traces of clinohypersthene were noted in the thin section from Mass II. The first Mass is very similar to Mass III. The meteorite is an olivine-hypersthene chondrite showing advanced recrystallisation, of the sub-class "amphoterite" (olivine, Fa_{28}), and of the mineralogical and textural class 5 of van Schmus and Wood (1967). The specific gravity is 3.49. The main masses are held in the collection of the School of Mines, Kalgoorlie (Nos. 10547, 10553 and 10555) and

[1] Olivine not optically determinable due to limonite coating: diffractometric peak low and diffuse around Fa_{24} (B. Mason, written communication).

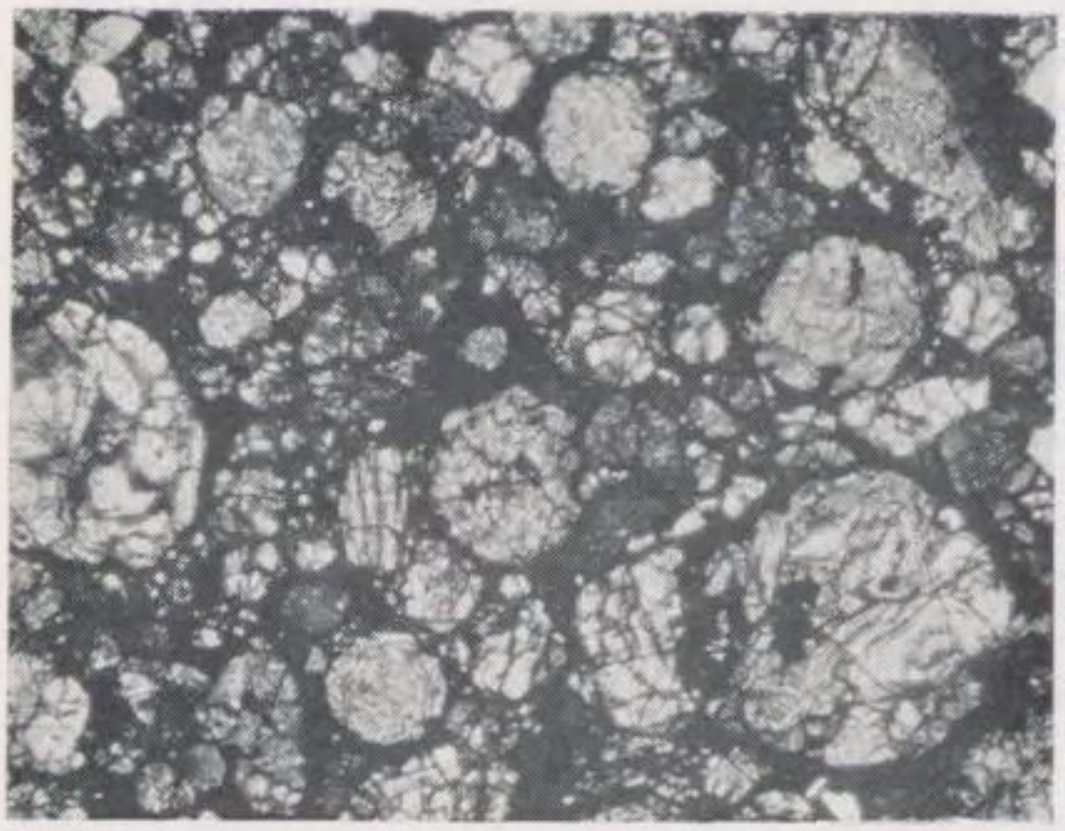
the meteorite is also represented in the collection of the Western Australian Museum by thin sections (W.A.M. No. 13109).

Oak.—Find, 1968, by D. A. Carlisle about 20 miles north-west of Mundrabilla station homestead, a single mass weighing 75.3 grams, faceted and coated by brown fusion crust. Orientation characteristics are evident, the rearward facing surfaces in ablation flight being rough and mottled, whereas the other surfaces are smooth-crusted. The freshly cut surface is grey and sparsely speckled with fine nickel-iron, surrounded by some limonite stain. The microscope reveals a most unusual texture. The meteorite consists of contrasting patches of very finely granular material and very coarsely recrystallised material. There is little trace of chondrules in the coarse material, but the fine material displays quite well formed chondrules. Plagioclase (oligoclase), showing very faint lamellar twinning, is abundant in the fine areas—indeed it is more abundant than in any chondrite previously examined by the author responsible for the petrographic examination (G. J. H. McC.). The opaque minerals are coarsely aggregated in the coarse fraction, and finely aggregated in the fine fraction. There is a little plagioclase in the coarse fraction, and the two fractions could well be products of coarse and fine recrystallisation of similar initial material, though there may be compositional disparity. The pattern is not unlike the "light-dark" pattern of some brecciated chondrites (Keil and Fredriksson 1963). There are traces of lamellated clinohypersthene. The meteorite is an olivine-hypersthene chondrite (olivine, Fa_{25}) of the mineralogical and textural type 5 of van Schmus and Wood (1967). Its specific gravity is 3.31, a surprisingly low value, for the meteorite is not strongly ferruginised—the high plagioclase content may be responsible for this low value. The main mass is held in the collection of the School of Mines, Kalgoorlie (No. 10390) and the meteorite is also represented in the Western Australian Museum collection by a thin section (W.A.M. No. 13111).

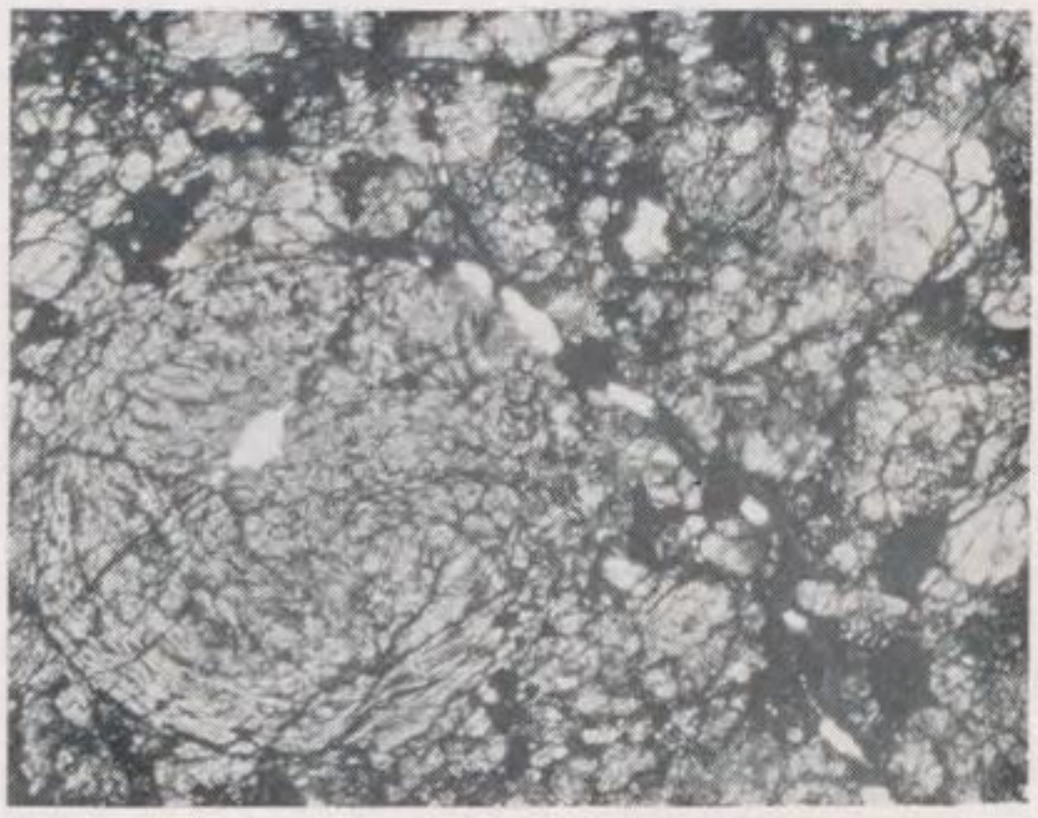
Reid (I and II).—Find, August 1969, by D. A. Carlisle (the first mass) about 48 miles north-north-east of Reid station on the Trans-Australian Railway line. The initial find was of a single, fractured, incomplete stone, weigh-

Figure 4.—Photographs of meteorite masses. A.—the Reid I meteorite mass, showing chondrules; B.—the North Reid I meteorite mass, showing the rough, rearward facing surfaces in atmospheric flight (facing the camera) and the smooth, anterior surface in ablation flight, above; C. and D.—the North Reid III meteorite mass, again showing the contrast between a rough, rearward-facing ablation surface and smooth anterior surface (scale bars in millimetres and centimetres).

ing 90.3 grams. Rounded chondrules are strikingly evident on a brown weathered surface, and there is little trace of fusion crust. The second recovery, of three small fragments weighing 35.3, 18.0 and 0.5 grams (total 53.8 grams) was made 10 miles to the south-west by A. J. and D. A. Carlisle in September, 1969, bringing the total to 144.1 grams. In thin sec-



A



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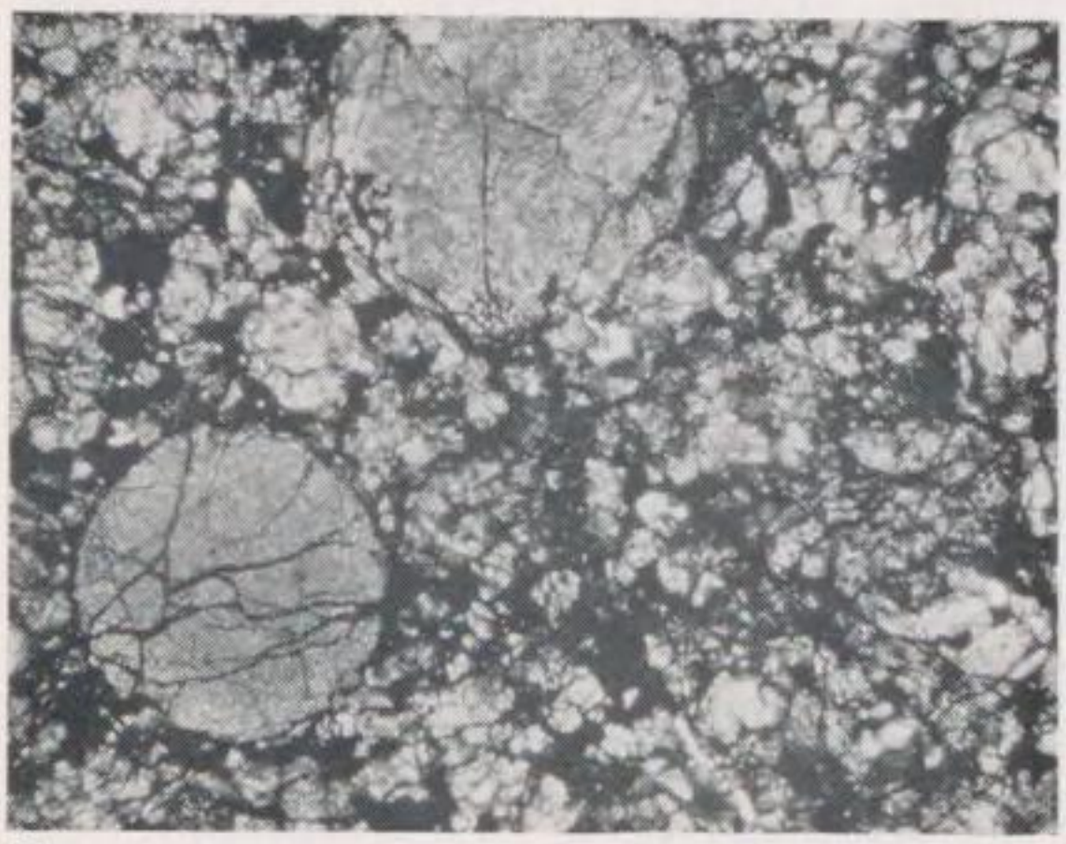
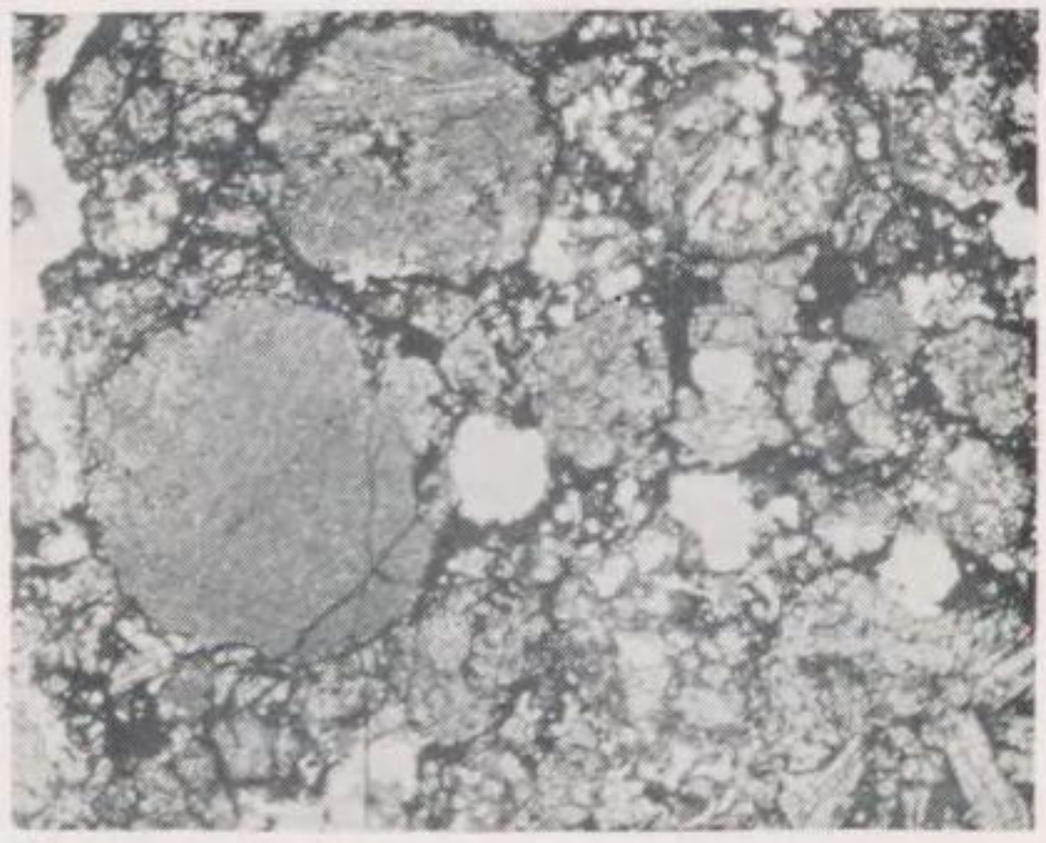


B



E

C

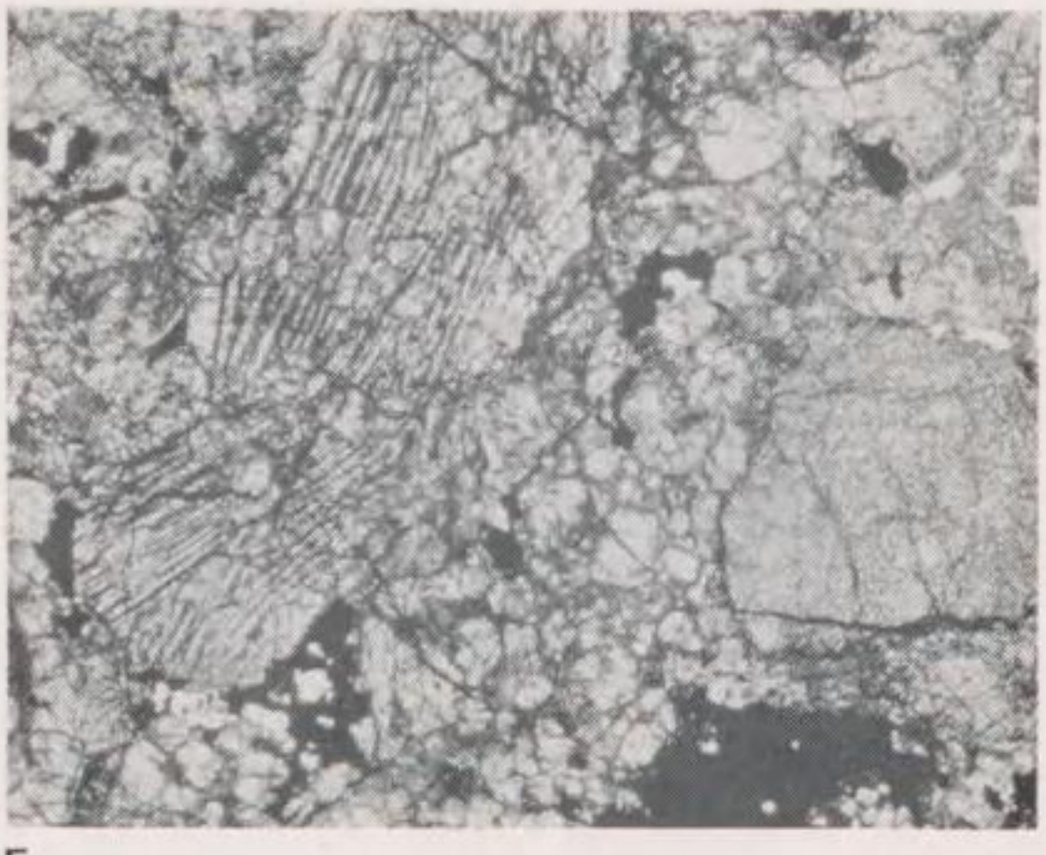


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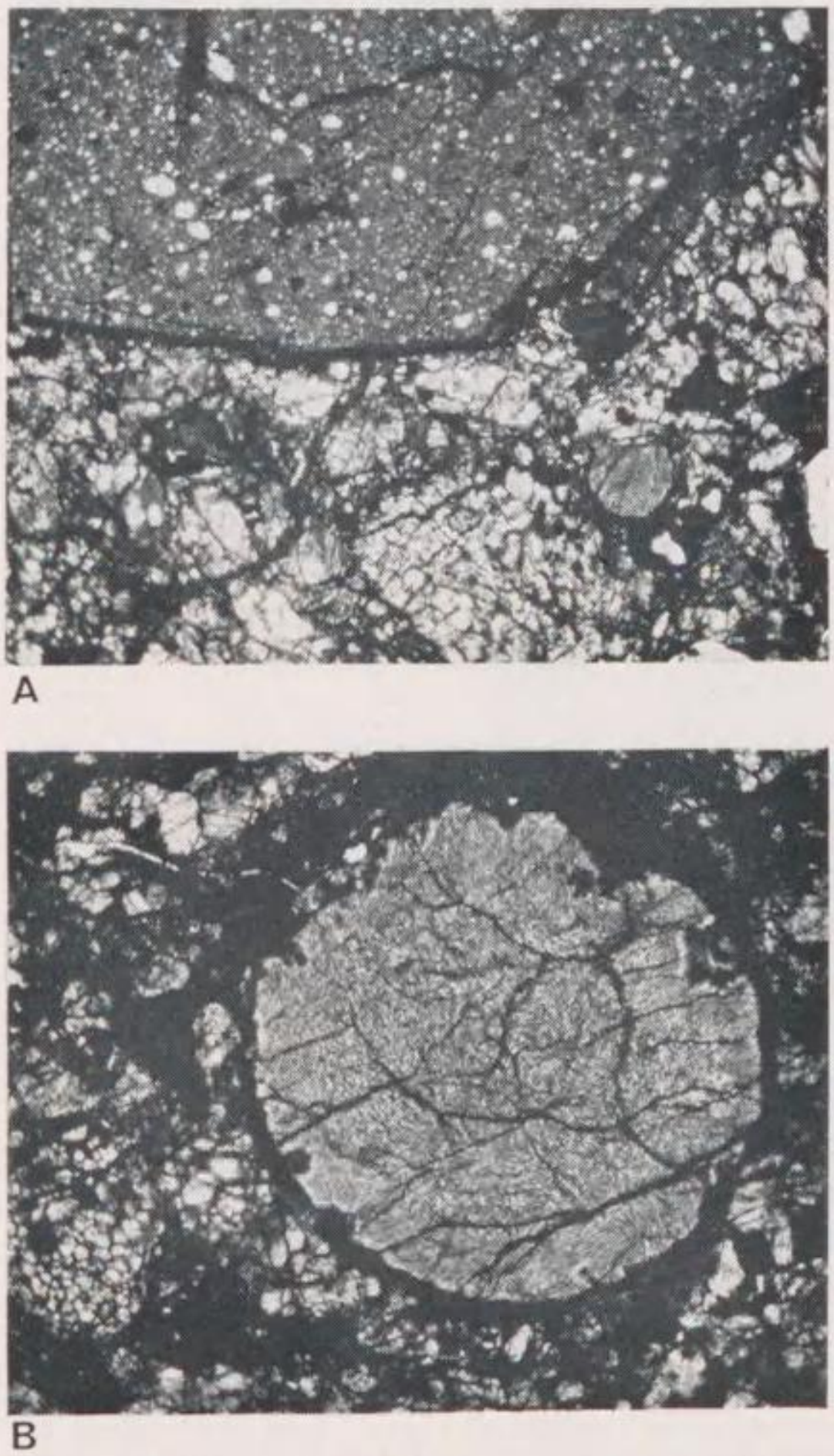
Figure 5.—Photomicrographs. A.—Laundry East meteorite, general view (x 20, plane polarised light); B.—Laundry Rockhole meteorite, general view (x 20, plane polarised light); C.—Laundry West meteorite, general view (x 20, plane polarised light); D.—North Forrest meteorite, general view (x 20, plane polarised light); E.—Reid meteorite, general view (x 20, plane polarised light); F.—North Reid meteorite, general view (x 20, plane polarised light).

tion, this meteorite displays a primitive character, being a spherical chondrite with chondrules less than 1 mm diameter, well-formed and of complex internal structure, set in a fine, ferruginised base, once probably a mixture of glass and fine crystal fragments. The meteorite is an unequilibrated olivine-hypersthene chondrite (fayalite content of olivine variable) of type 3 in the mineralogical and textural classification of van Schmus and Wood (1967). Nickel-iron is extremely scarce and this fact is reflected in the very low specific gravity, 3.14. The masses are held in the collection of the School of Mines, Kalgoorlie (Nos. 10544 and 10552), and the meteorite is also represented in the collection of the Western Australian Museum by thin sections (W.A.M. No. 13108). The several finds in the vicinity of the site of the Reid find are listed in Table 2.

Webb.—Find, June 1968, about twelve miles north-north-west of Mundrabilla Station Homestead, by E. J. Hockley; a single, brown, fusion crust coated, oxidised mass, weighing 410.5 grams. Of the same highly recrystallised type as Yayjinna, Burrika (McCall and Cleverly 1968) and North Reid, this meteorite reveals under the microscope a recrystallised aggregate of olivine, orthopyroxene and subordinate oligoclase (the felspar being very poorly twinned and aggregated with coarse, sparse developments of nickel-iron and troilite). Chondrules are discernible but have merged into the crystalline base, their boundaries being completely lost. The meteorite is an olivine-hypersthene chondrite (olivine, Fa_{23}), of the textural and mineralogical type 6 of van Schmus and Wood (1967). The specific gravity is 3.38. The main mass is held in the collection of the School of Mines, Kalgoorlie (No. 10317), and the meteorite is also represented in the Western Australian Museum collection by two small slices weighing 12.0 and 3.3 grams respectively, and a thin section (W.A.M. No. 12983).



A

B

Figure 6.—Photomicrographs. A.—Forrest meteorite, showing the facetted, fine textured, achondritic (?) enclave, top (x 50, plane polarised light); B.—Gunnadorah meteorite, general view (x 50, plane polarised light).

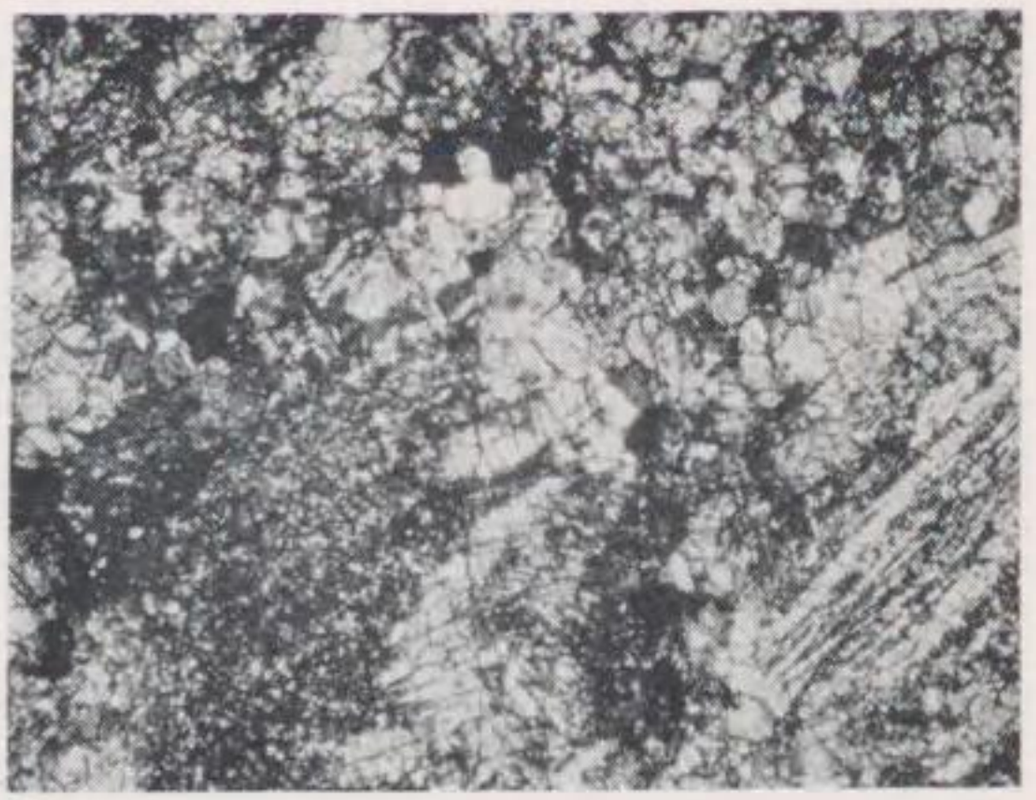
West Reid.—Find, November 1969, by N. R. Carlisle, a single entirely fusion crust enveloped, oriented stone, weighing 627.7 grams. The mass shows a rough, pitted surface (the rearward facing surface in ablation flight) and a concave, rounded and weakly faceted opposing face, covered with a shiny, chocolate coloured, fusion crust. The rearward face consists of three orange-brown coloured, concave, pitted, well-defined facets, separated by a Y-shaped ridge pattern. The fresh-cut surface is brown and shows a fine speckling of metal and what appear to be faintly defined chondrules. In thin section the meteorite is seen to consist of a fine aggregate of olivine and bronzite (some of which shows a faint lamellation). Plagioclase is only sparingly evident. There is abundant finely aggregated metal and troilite. Chondrules are difficult to discern but faintly defined fan-chondrules, now almost merged in the base, were detected. The olivine is determined as Fa_{21} by diffractometry, a very unusual value for a chondrite; the orthopyroxene is Fs_{19}. It appears to be a highly recrystallised olivine-bronzite chondrite of van Schmus and Wood's class 6—one that has lost definition of virtually all its chondrules. Comparison may be drawn to the unique Shaw chondrite which is chondrule-free (Mason 1967), but the texture is less coarsely crystallised than that of

TABLE 2

Meteorites discovered north of Reid in **1969** *(Coordinates for Reid and North Reid in Table* **1** *refer to the initial finds only.)*

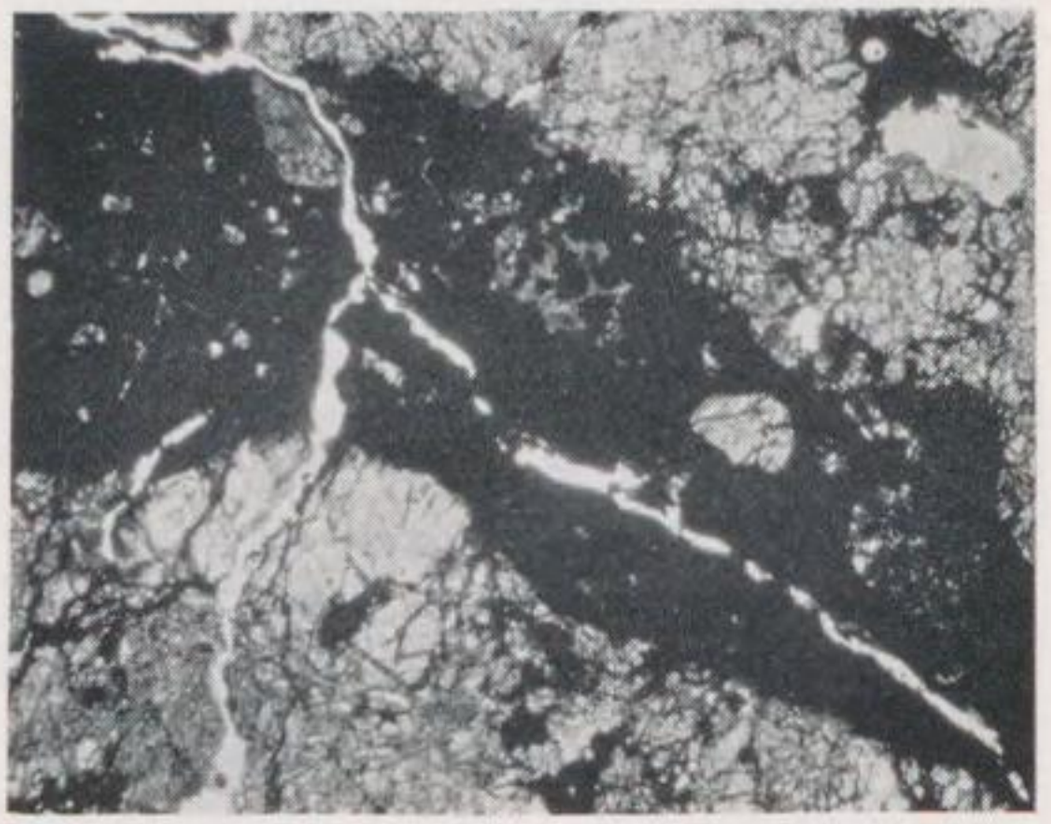
School of Mines, Kalgoorlie No.	Notation used by D. Carlisle on sketch	Name adopted	Co-ordinates	
			Longitude E.	Latitude S.
10544	"North Reid"	*Reid I*	128° 41′	30° 11′
10552	NR 3	*Reid II*	128° 34′	30° 17′
10547	NR 2	*North Reid I*	128° 38′	30° 08′
10553	NR 4	*North Reid II*	128° 38′	30° 16′
10555	NR 6	*North Reid III*	128° 37′	30° 14′
10554	NR 5	*North East Reid*	128° 43′	30° 09′
10564	—	*West Reid*	128° 40′	30° 11′

A



B

C



D

E

Figure 7.—Photomicrographs. A.—Oak meteorite showing contrasting coarse textured and fine textured areas (x 20 crossed nicols); B.—Webb meteorite, general view (x 20, crossed nicols); C.—Coorara meteorite, unusual felspathic area, showing felspar (light) inset with prisms of a brown, altered mineral, probably olivine (x 20, plane polarised light); D.—Coorara meteorite: dark veins carrying ringwoodite (grey) and majorite (x 20, plane polarised light); E.—North East Reid meteorite; general view (x 25, plane polarised light).

A

B

C

D

Figure 8.—A.—The West Reid meteorite—anterior surface in ablation flight; B.—The West Reid meteorite—posterior surface in ablation flight (scale bars in millimetres); Photomicrographs. C.—the characteristic chondrule-free, highly recrystallised but fine texture of the West Reid meteorite (x 17, plane polarised light); D.—One of the sparse, fan-chondrule relics in the West Reid meteorite (x 43, plane polarised light).

Shaw. The specific gravity is 3.46. The main mass is held in the collection of the School of Mines, Kalgoorlie (No. 10564), and thin sections are held in the collection of the Western Australian Museum (W.A.M. No. 13129).

Discussion

These new recoveries emphasise the peculiarly favourable conditions for meteorite preservation afforded by the surface of the arid, almost waterless Nullarbor limestone desert or gibber plain. It seems that historically ancient meteorite masses must be included together with some quite fresh masses (such as Mulga North and Cocklebiddy) in the Nullarbor recoveries. There has been considerable overprinting of falls of different dates, especially in the case of the two Mulga groups, Dingo Pup Donga and Coorara, and the newly discovered complicated Reid group (Reid, North Reid, North East Reid and West Reid). The evidence of Vdovykin (1968a, b) suggests that even the two ureilites, North Haig and Dingo Pup Donga are products of quite distinct and chronologically separate falls. Of particular interest is the seeming proliferation of small stones, and relative paucity of large stones, large iron masses and achondrite masses. Comparison between the Nullarbor Plain and other areas of comparable size elsewhere in the world that have yielded many iron masses of considerable size—for example, Mexico, Chile, S. W. Africa and the western wheatbelt of Western Australia—suggests that there must be some controls, possibly in the nature of orbital geometry, that determine the uneven terrestrial distribution of meteorites by type—controls as yet little understood. Perhaps meteorites of one type sharing the same limiting orbital geometry tend to strike a restricted area of the Earth's surface repeatedly in successive orbital interferences. It seems clear that falls of chondritic stones of no great size overwhelmingly predominated in the more recent past amongst meteorites striking the Western Australian half of the Nullarbor Plain, and it seems surprising that, with such perfect conditions for long preservation of irons (proved in the case of the iron shale beneath the immense Mundrabilla irons discovered (or more correctly rediscovered) in

1966—McCall 1968), only these two large paired irons and the large Haig iron (McCall and de Laeter 1965; Cleverly 1968) have yet been recovered from the surface of the Nullarbor Plain, in Western Australia. It may be that we are only just beginning to comprehend the complexity of the controls exerted on terrestrial meteorite distribution.

Acknowledgments

The authors are once again indebted to the Carlisle family engaged in rabbit trapping on the Nullarbor Plain: also to Dr Brian Mason of the Smithsonian Institution, Washington, who has continued over the years to supply them with accurate diffractometric and optical determinations of the olivines in meteorites. Mr W. Smeed and Mr K. C. Hughes once again carried out the supporting lapidary and photographic work for this study. Mr M. K. Quartermaine assisted in the field work of fixing the sites of find and searching the vicinities; incidental to this work, he discovered two meteorites which he donated to the official collections.

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