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The Credo and Fenbark meteorites, new finds of common chondrites from north-west of Kalgoorlie, Western Australia

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SUMMARY. Two new finds of stony meteorites north-west of Kalgoorlie are described, and the masses covered by brief petrographic descriptions.

Credo

A SINGLE stony meteoritic mass, entirely covered with fusion crust except for a small area of the surface from which some small flakes had been naturally lost, was found by Mr. P. J. Howell early in October 1967, on Credo Station, to the north-west of Kalgoorlie, Western Australia (fig. 1). The place of find is 30° 22′ S., 120° 44′ E., 8·9 miles on a bearing of 325° from Credo Sheep Station Homestead. The mass (fig. 3) is faceted and cushion-shaped. It is entirely covered by a smooth, chocolate-brown melt skin, with isolated areas of regmaglypts tending to grouping around the edges of the cushion, separating two extensive areas of flat facets, devoid of regmaglypts. The two facets on one side are appreciably rougher than those on the other side, and the melt skin appears to be appreciably thicker. The conclusion is drawn that *Credo* is an oriented meteorite having the attitude shown in fig. 2 while in atmospheric entry flight. The orientation of faint striae on the flat surfaces supports this conclusion.

The broken surface has a reddish coloration, and the mass, when cut with a diamond saw at one corner, revealed a surprisingly weathered interior, in spite of the virtually complete fusion crust enclosure. The cut face is greenish-grey, medium-textured, and specked by sparse, lighter-coloured chondrules. One or two of these are unusually large (*c.* 1 cm in diameter). There is relatively little metal present, which immediately suggests a Chy classification: what metal there is has been attacked by weathering agents, and the patches of metal are surrounded by haloes of brown oxide stain. The specific gravity is 3·41.

A thin section shows the meteorite to be a highly recrystallized chondrite, though chondrules are still clearly discernible: there is one fan chondrule 0·7 mm in diameter. The mineralogy is entirely normal for an olivine-hypersthene chondrite, olivine predominating and being associated with subordinate orthopyroxene, some of which

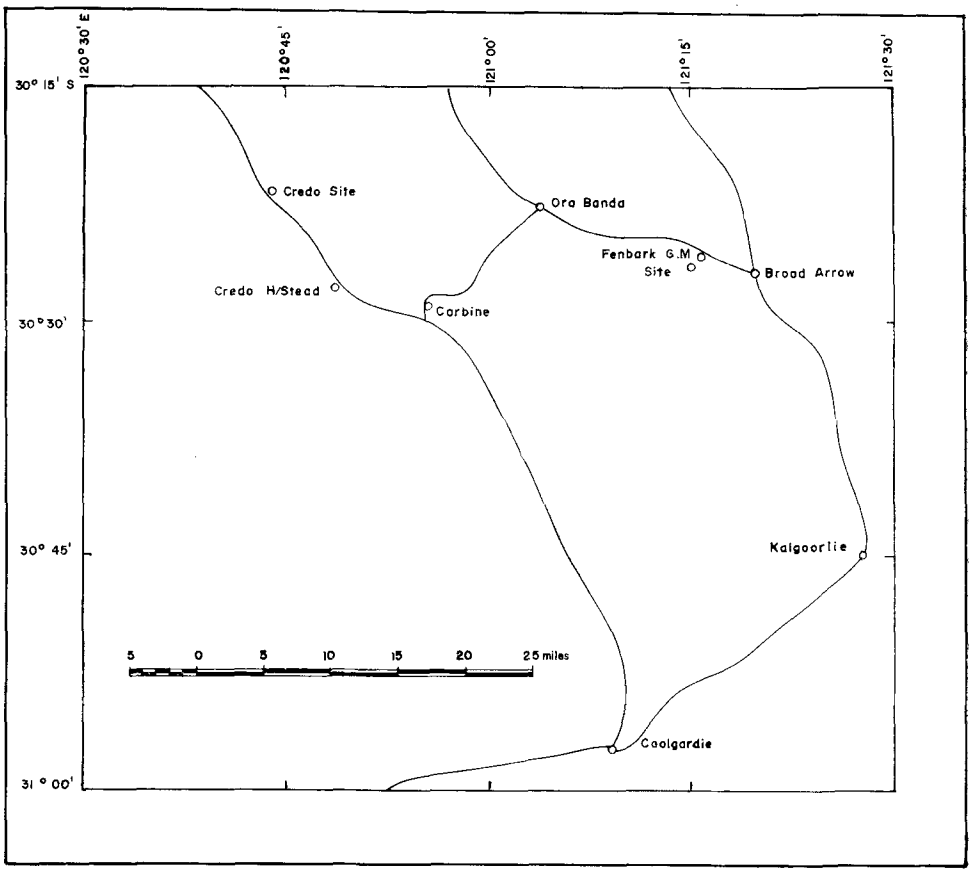


FIG. 1. Sketch-map showing the area of recovery of the Credo and Fenbark meteorites.

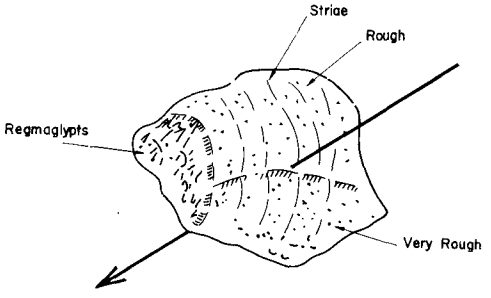
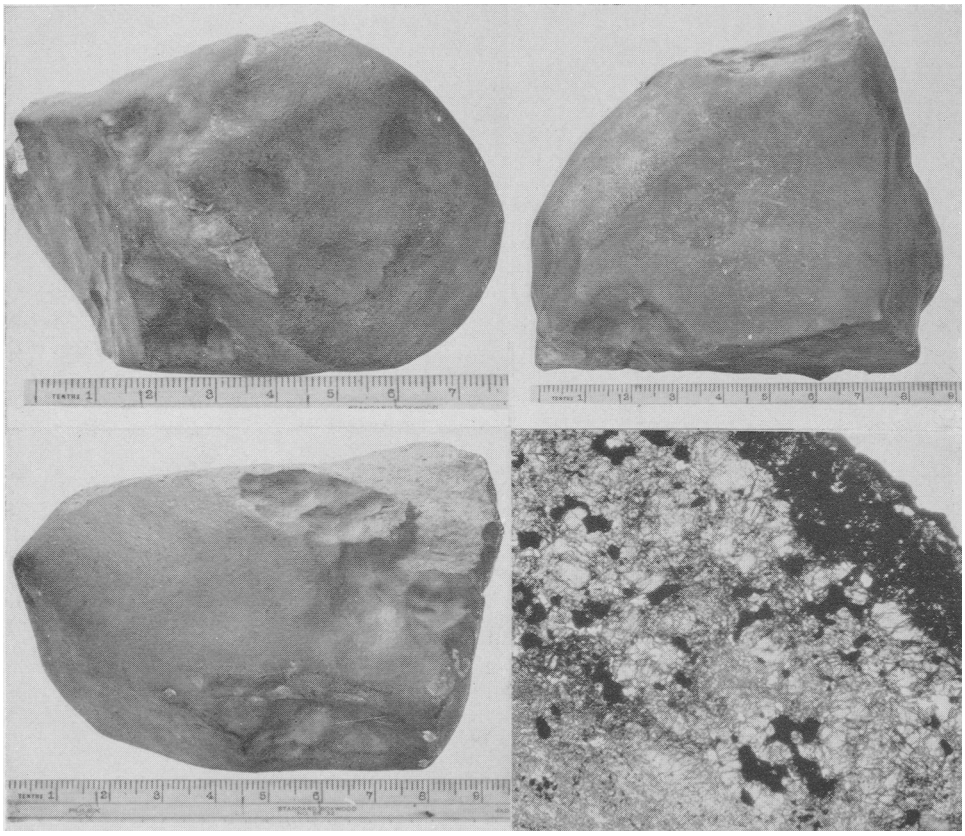


FIG. 2. Drawing showing the deduced attitude while in ablation flight of the Credo meteorite.

shows faint longitudinal lamellation. The nickel-iron and troilite aggregates are rather course and irregular. Commonly associated with these opaques, but also occurring as isolated interstitial grains, are small grains of plagioclase, a few of which

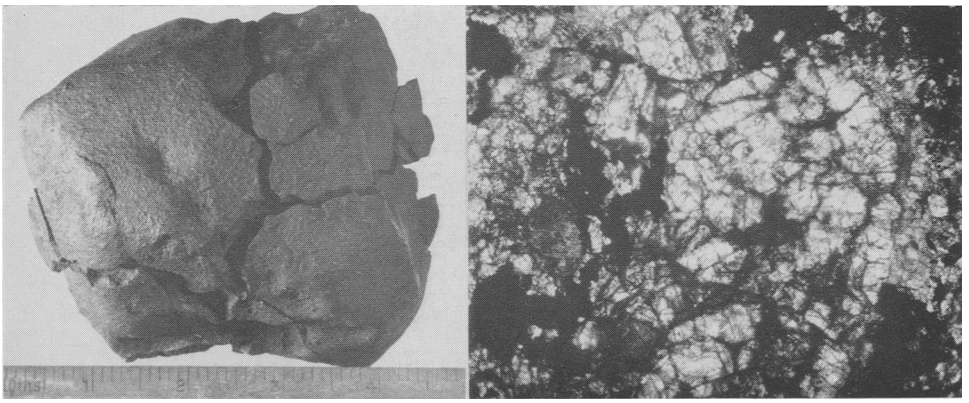


FIGS. 3 and 4: Fig. 3 (*a*) (top left). View of the Credo meteorite showing the rougher textured, rearwards facing surface (in ablation flight) and the waist zone, pitted by regmaglypts. (*b*) (top right). View of the Credo meteorite showing the rougher textured rearwards facing facets. (*c*) (bottom left). View of the Credo meteorite showing a smooth, rounded, and faintly striated facet, on the forward facing surface in ablation flight. Also visible are regmaglypts and the flaked off section of the melt skin. All scale bars are in inches. Fig. 4 (bottom right). Photomicrograph, showing the recrystallized texture: olivine and orthopyroxene, *grey*, nickel-iron and troilite, *black*, opaque: the fusion crust shows *upper right*: part of the largest chondrule is visible, *lower left* (× 35, plane polarized light).

display albite twinning. The extinction of the lamellae on one grain suggests a composition about An_{23} (oligoclase) but this identification is only tentative. A colourless mineral of similar low relief, almost isotropic, is believed to be maskelynite after plagioclase (a common constituent of such recrystallized chondrites).

The olivine was determined as Fa_{24} by Dr. B. Mason using the X-ray diffractometer method of Yoder and Sahama (1957), and this is in accord with the determination

of the meteorite from the petrographic evidence as a recrystallized olivine-hypersthene chondrite. The main mass was presented to the collection of the School of Mines, Kalgoorlie, by the finder, who retains a 212 g cut section and a cast of the mass: the main mass weighed 10·82 Kg (23 lb 12 oz) before cutting. A cut slice (260 g) and cast of the entire mass is held by the Western Australian Museum (W.A.M. 12936), together with two thin sections, and the balance of the main mass (10·3 Kg) remains in the School of Mines, Kalgoorlie Collection, No. S.M.K. 10280.



FIGS. 5 and 6: Fig. 5 (left). Reassembled fragments of the Fenbark meteorite, showing the form of the single, fusion-crust coated mass. FIG. 6 (right). Photomicrograph, showing one spherical chondrule affected by the general brecciation of the chondritic material of the Fenbark Meteorite. Olivine and orthopyroxene show *grey*, nickel-iron and troilite (together with iron oxides of terrestrial derivation) *black*, opaque (× 50, plane polarized light).

Fenbark

A single, weathered and cracked mass was recovered by members of a nickel-prospecting syndicate, Messrs. A. A. Skinner, K. J. Erbe, and F. C. Bray, at a point a quarter of a mile on a bearing of 8° from Mt. Ellis trigonometrical station, in the general vicinity of the Fenbark group of gold-mining leases (fig. 1) north-west of Kalgoorlie, on 19 May 1968. The mass was already cracked and decomposed by weathering agencies, and suffered further breakage and partial destruction artificially, for, on account of the positive reaction for nickel to the dimethylglyoxime test, and the present interest in nickel-prospecting in this area, part of it was crushed and assayed before its true nature was understood. The remainder can be reassembled into a single faceted, globular mass, the broken surfaces of which are deeply iron-stained, and which shows fusion crust curving around it in such a manner that it is certain that only a small part of the original mass has been lost due to human agency. The main mass and fragments totalled 1861·7 g before three fragments were returned to the finders (one to be kept by each), 1565 g now remaining in the collection of the Kalgoorlie School of Mines (No. S.M.K. 10305) (of which 82 g were recovered with the assistance of Mr. M. K. Quartermaine). The Western Australian Museum has two small fragments (25·4 and 13·0 g) and a thin section (W.A.M. No. 12974).

The lack of further recovery suggests that this, like Credo, was a solitary arrival—however, its much more weathered state and the fact that it is of a different class removes any possibility of contemporary arrival on Earth.

The co-ordinates of the site of find are 30° 26′ 25″ S., 121° 15′ 25″ E.

The thin section (fig. 6) reveals a fine texture, numerous small spherical chondrules being visible, many of which show more than one internal texture, and contain more than one of the two ferromagnesian silicate minerals, olivine and orthopyroxene. There is a trace of feldspar present, and some areas of fine, grey material that seems to be devitrified glass within the chondrules. The texture suggests some degree of brecciation, many of the chondrules being deformed and broken; there is some degree of recrystallization, exactly how much is difficult to assess on account of brecciation and alteration. The rather abundant flecks of nickel-iron are of irregular outline and show a very subordinate aggregation of troilite. The material is penetrated by iron oxides, due to terrestrial weathering, along numerous fine cracks.

The olivine has been determined as Fa_{18} by Dr. B. Mason, using the method of Yoder and Sahama (1957)—a value that is in agreement with the abundance of metal flecks, a typical feature of olivine bronzite chondrites. It is classified a Cbr (brecciated).

REFERENCE

YODER (H. S.) and SAHAMA (T. G.), 1957. *Amer. Min.* **42**, 475–91.

[*Manuscript received 31 October 1968*]