The sequence of sex allocation in parasitoids is known to be non-random for most of the gregarious and quasi-gregarious parasitoids and random for solitary ones[4]. However, the greater probability of fertilization of alternate eggs by a solitary parasitoid *T. indicus* demonstrates a non-random sex allocation in a sequence[5]. This is the only available information for aphid parasitoids. Predominance of female progeny observed in host-patches of variable size collected from field population[7,8], suggests that the female allocates only as many haploid eggs in the host-patch as are sufficient enough for the brood. This kind of adaptive sex allocation in aphid parasitoids differs significantly with random sex allocation as observed in solitary parasitoids where mean sex ratio is more important[4].

Since several factors influence the fertilization of eggs[9], the sequence of deposition of haploid–diploid eggs has certain limitations. Therefore, the sequence alone is of little adaptive significance for the females.

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SHARMILA PANDEY
RAJENDRA SINGH

Aphid Biocontrol Laboratory,
Department of Zoology,
University of Gorakhpur,
Gorakhpur 273 009, India

Didwana–Rajod meteorite: An unusual chondrite

A stony meteorite fell on 12 August 1991 at 10.00 PM at a site near Didwana in Nagaur District, Rajasthan, India (Figure 1). It fell in the open field of village Soanlias P.O. Rajod, and was picked up by Sohan Ram, an undergraduate student residing in the village.

The stone is fully crusted and free of fractures. It contains typical thumb marks of a meteorite (Figure 2). The fusion crust is moderately thick. A face of the stone was polished to show internal structures (Figure 3). On megascopic examination, the polished surface shows poorly-developed banded structure, dark brown chondrules and a few creamy white specs. The polished surface deteriorates rapidly by rusting of metallic grains. This is the first report on this meteorite fall and this meteorite is named the 'Didwana–Rajod meteorite'.

Thin sections covering nearly 10 cm^2 area were studied under the microscope. The rock under thin section consists of a variety of chondrules set in a fragmental matrix predominantly consisting of enstatite and metallic phases. The chondrules are distinct in shape (sometimes ideally spherical) and some of them are moderately degraded. Chondrules are generally 0.1 to 1 mm in size, except one which is 5 mm in size (Figure 2) observed on the broken surface of the meteorite. The type of chondrules encountered in Didwana–Rajod meteorite is described below:

Very cloudy glassy-looking chondrules exhibit one of the best spheroidal geometries. Although they look glassy and are very uniform under plane polarized light, they show an exocentric chondrule-like extinction pattern. These chondrules have a metallic phase which is sometimes seggregated (Figure 4) and at times totally diffused in the body of the chondrule. In the cryptic crystalli-

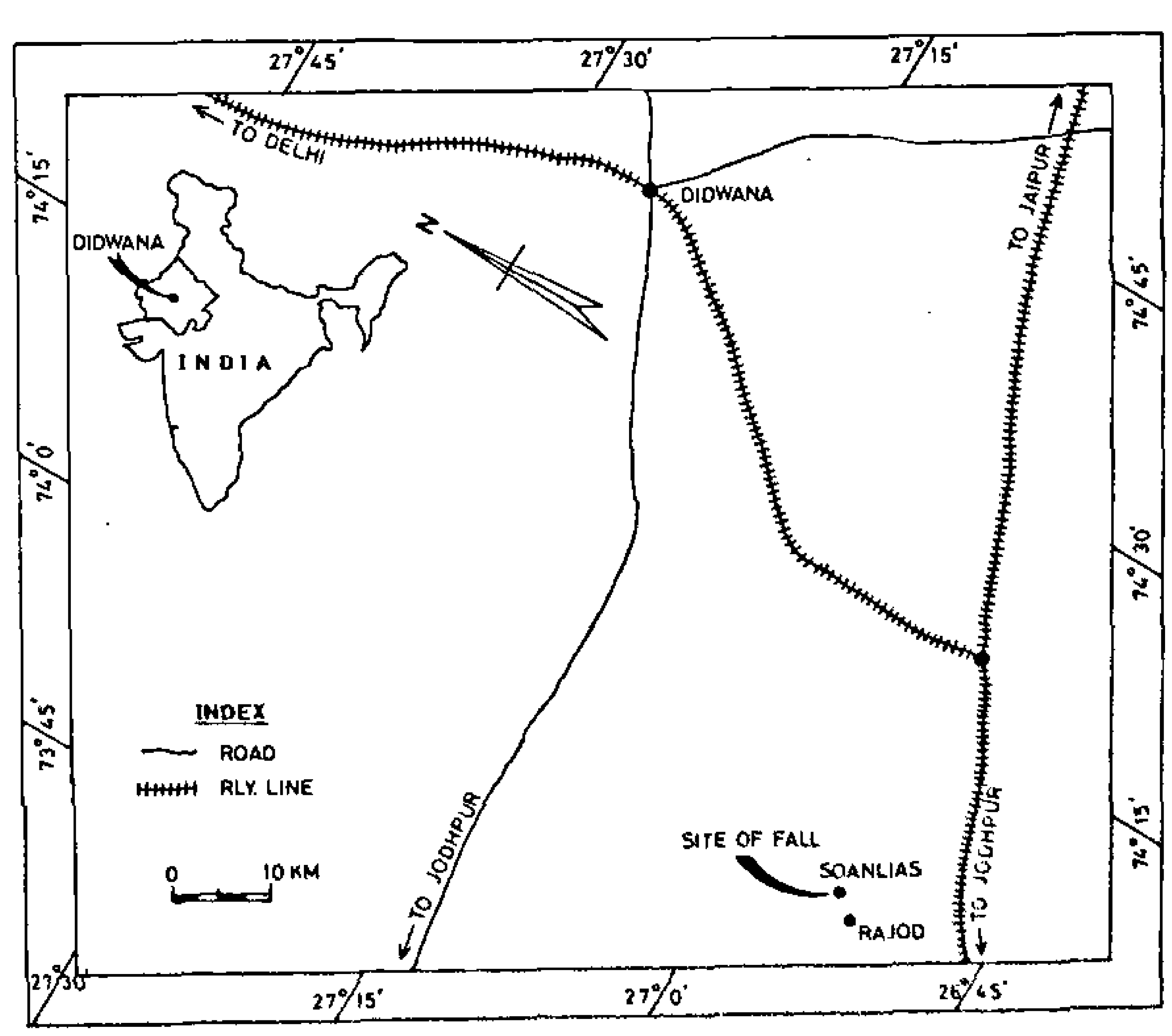

Figure 1. Location map of fall site.

Figure 2. Didwana–Rajod meteorite showing fusion crust. A large dark brown 5 mm chondrule is seen in the broken surface (coin size 1.9 cm).

Figure 3. Polished surface photographed after 24 h showing rusted metallic grains and poorly-developed banded structure (coin size 1.9 cm).

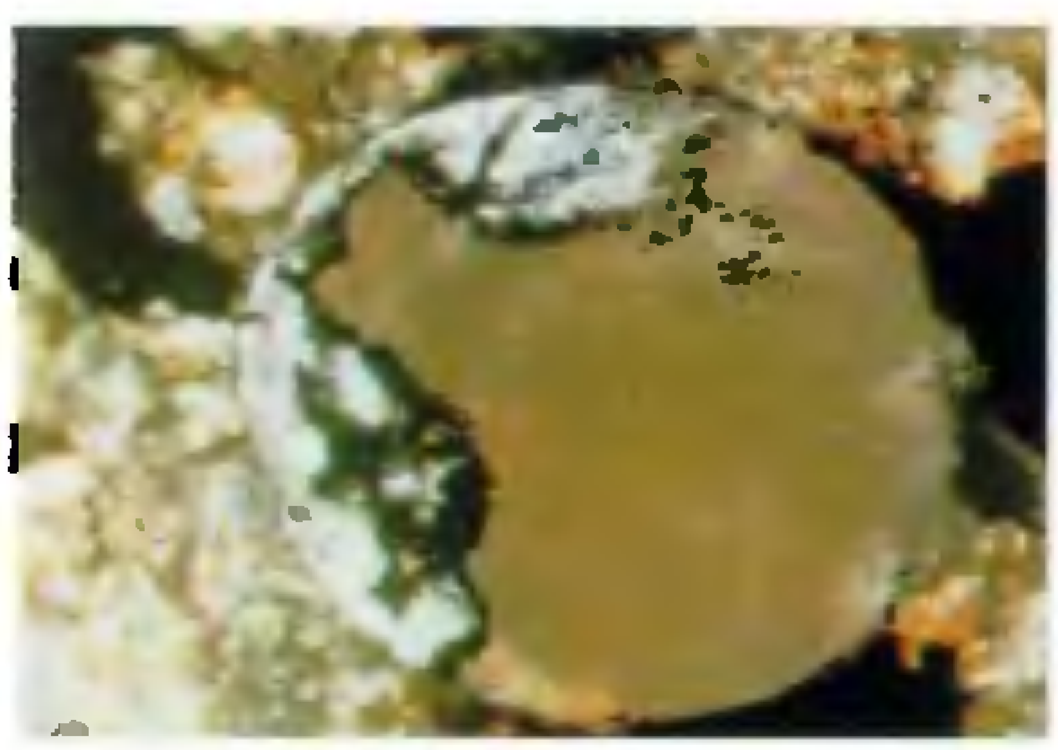

Figure 4. Photomicrograph showing a glassy chondrule devetrified and recrystallized on one side. Note the seggregation of metallic phase from silicate in the recrystallized zone (Nicols crossed, Field view 1.1. mm).

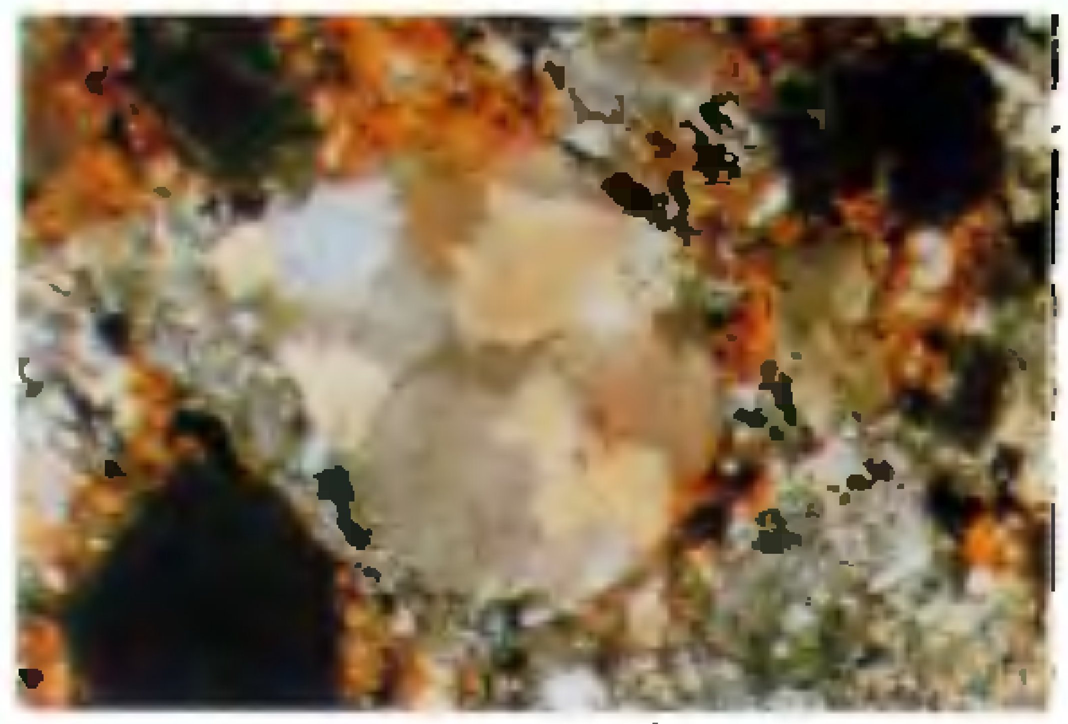

Figure 5. Photomicrograph showing a swirling fabric in an enstatitic chondrule. Absence of metallic or glassy phase may be noted. Fragmented matrix is iron stained, the chondrule is unstained. (Nicols crossed, Field view 1.1 mm).

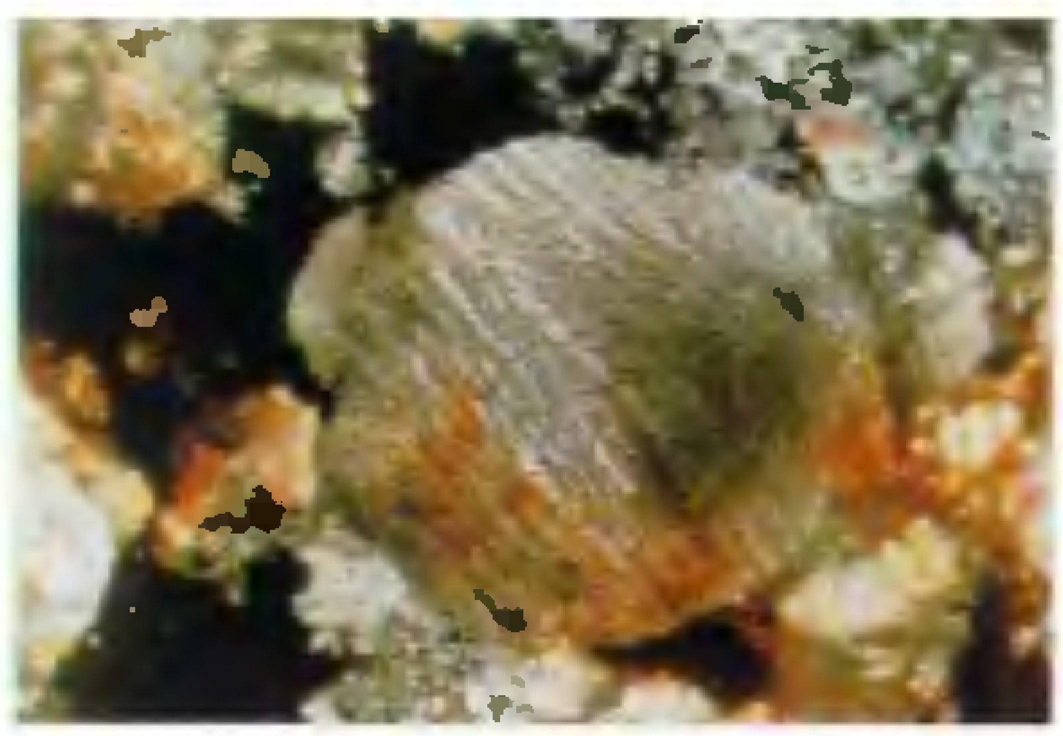

Figure 6. Photomicrograph showing an exocentric fan fabric with superposed bar fabric in a chondrule; iron staining may be secondary. (Nicols crossed, Field view 1.1 mm).

Figure 7. Photomicrograph of an enstatite barred chondrule. A small perfect spherical glassy chondrule by the side of bigger barred chondrule. (Nichols crossed, Field view 1.1 mm).

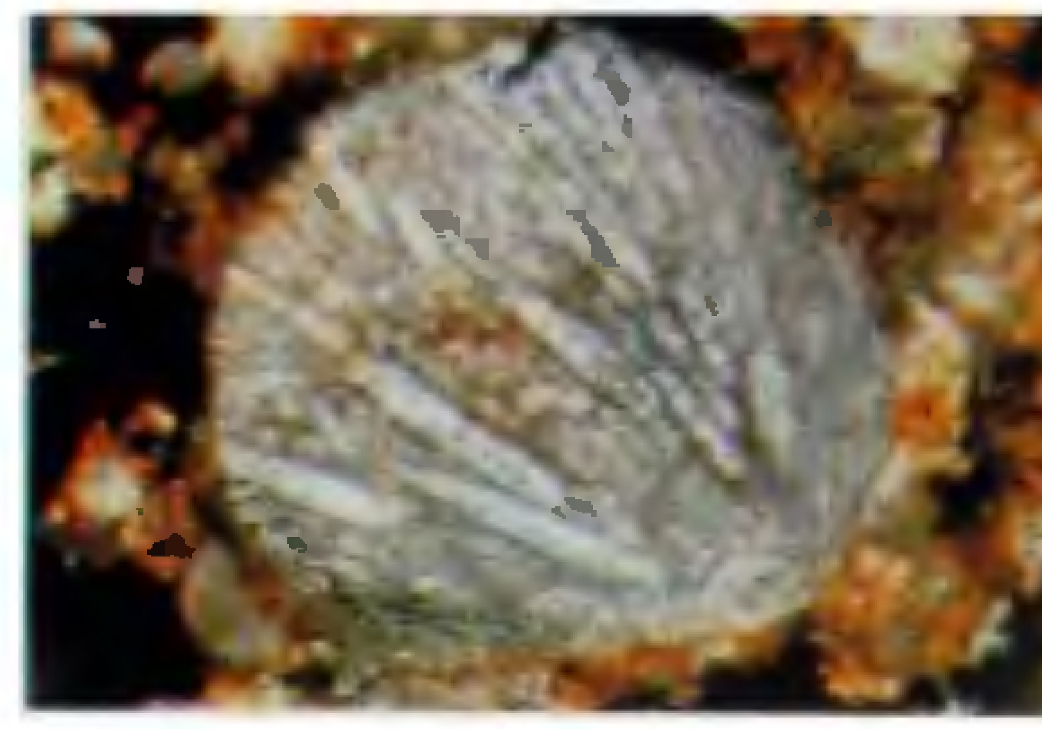

Figure 8. Photomicrograph showing an enstatitic fan fabric with metallic/glassy material bordering the features. (Nicols crossed, Field view 1.1 mm).

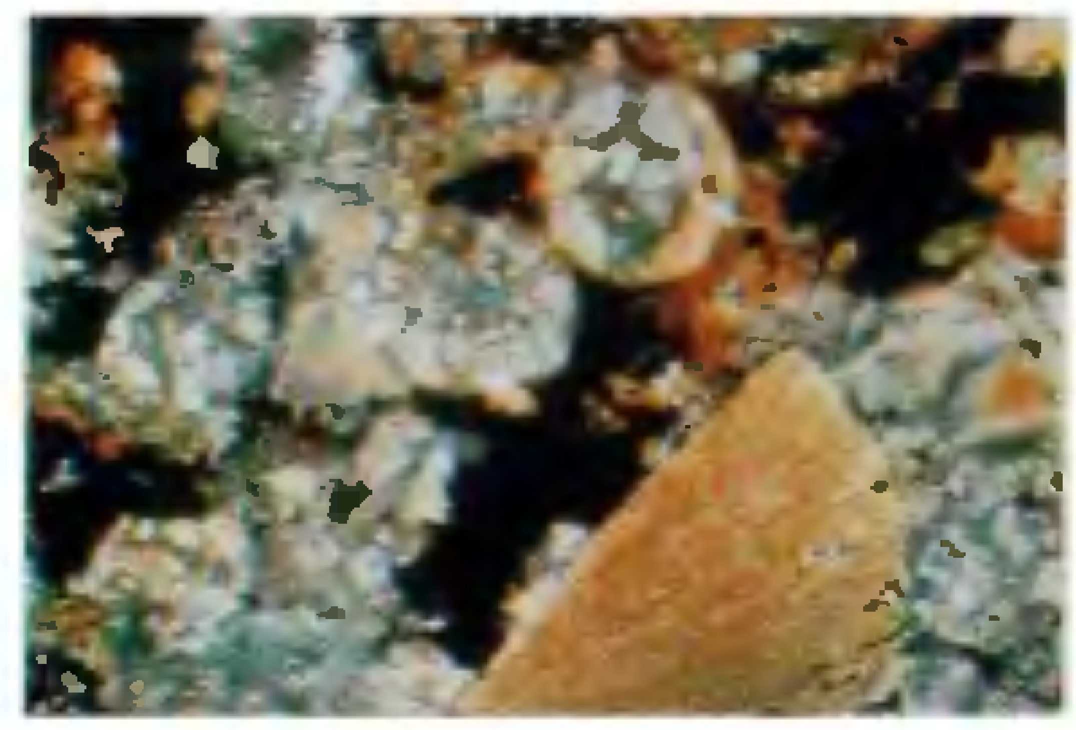

Figure 9. Photomicrograph showing a porphyritic chondrule in different states of degradation. A fragment of exocentric chondrule in the lower half is seen. At least eight porphyritic chondrules can be identified. (Nicols crossed, Field view 2.75 mm).

Figure 10. Photomicrograph of a ringed porphyritic chondrule (Plane polarized light, Field view 1.1 mm).

zation condition, the metallic phase does not separate out. Rims of these glassy chondrules always have a discontinuous sulphide mineralization. In all of these chondrules, a sweeping extinction is seen which shows that crystallization had taken place in an exocentric radiating pattern. This sometimes results into an extinction looking like pseudo-isogyres sweeping across the chondrule. These chondrules are almost spherical or slightly elliptical in shape. These chondrules give brisk effervescence on acid application.

Some of the chondrules show a ringed bar structure. In one such monosomatic barred chondrule, entirely made up of orthoenstatite with a very little glassy phase in between, the bars are arranged as rings. It has a well-defined boundary and troilite crystallization along it (Figure 5). This type of chondrule has areas of crystallographic continuity spreading from the centre to the periphery of the chondrule. These areas of crystallographic continuity are arranged in a radiating pattern (Figure 5) across which the crystallographic orientation changes sharply. Radially-aligned fractures are also seen. This type of trachytic flow arrangement could be

Figure 11. Photomicrograph showing a Ringed-radial chondrule with the laths of enstatite and metallic sulphide in the interstices. A glassy chondrule in upper right part is seen. (Nicols crossed, Field view 1.1 mm).

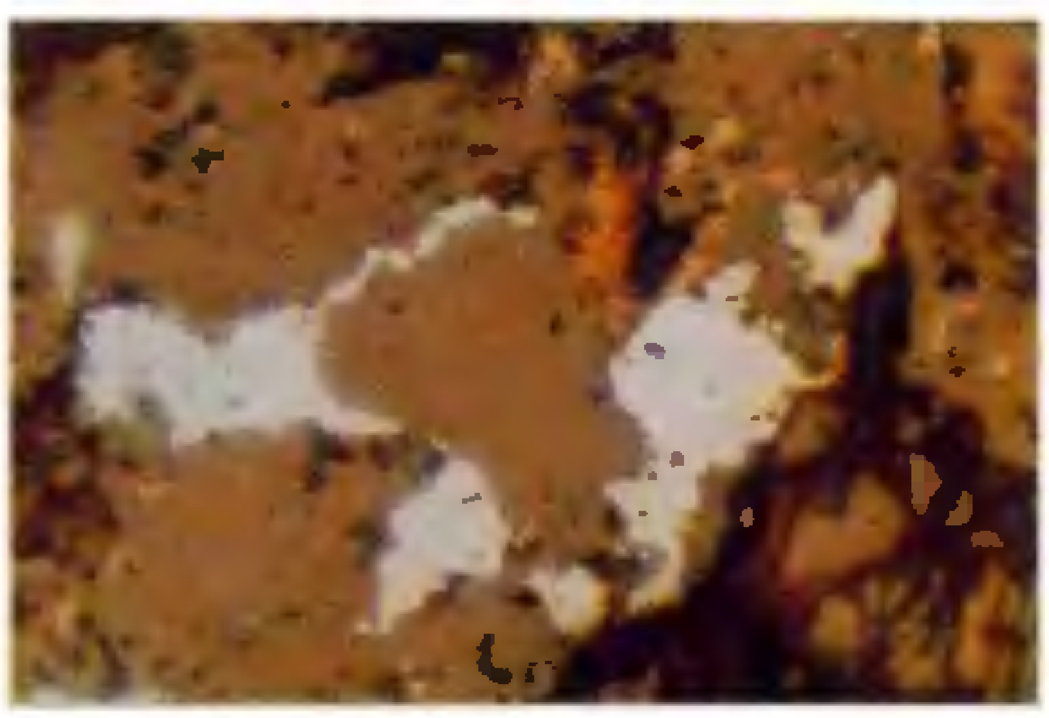

Figure 12. Photomicrograph of the metallic matrix. Elemental iron (white) showing high reflectance. Troidlite filling irregular interstices (Plane polarized light, Field view 1.1 mm).

Figure 13. Photomicrograph of a large chondrule showing tiny troidlite in reflected light. (Plane polarized light, Field view 1.1 mm).

because of crystallization from swirling droplets.

One of the less common types of chondrules (only three were seen in the thin section area of 10 cm^2), contains exocentric as well as barred feathery pyroxene (Figure 6). Interstitial area, between the parallel bars as well as exocentric radiating feathery bars, contains some metallic sulphide and other glassy matter (Figure 7). The crystalline phase is monosomatic in nature and the crystallization is in crystallographic continuity of exocentric orientation. However, the bars are nearly at right angles to the exocentric feathers (Figure 6) and the crystallographic continuity of exocentric feathers with barred areas may be fortuitous. The feathered chondrules probably owe their origin to instantaneous crystallization of a supercooled metastable phase. Superposition of barred structure is enigmatic, and may be due to coalescing of chondrules.

Exocentric fan chondrules are quite common as fully-developed chondrules as well as fragments. They are generally monosomatic and contain cloudy glass and metallic minerals in the interstices of feathery crystalline silicates (Figure 8). Colourless enstatite is the general constituent. Some pyroxenes are slightly dark in colour due to a higher iron content.

Porphyritic chondrules are the most numerous of all chondrule types present in the meteorite. They occur in various stages of degradation (Figure 9). Most porphyritic chondrules are monosomatic in nature but polysomatic chondrules (olivine–pyroxene) are also seen. In one of the olivine monosomatic chondrules, skeletal olivine crystals enclose glass/cryptic phase. In porphyritic chondrules the mineral grains are generally subhedral. Glassy matrix is generally interstitial and the metallic content of the matrix is generally concentrated towards borders in degraded chondrule. In none of the porphyritic chondrules was clear glass seen. It is generally cloudy and cryptic crystallized. Some are pure olivine with cloudy cryptic phase filling up the interstices.

Ringed-radial chondrules are the rarest among chondrules. Normally they have rings of radial enstatite with or without metallic grains. Central portion is fully crystalline, which is either porphyritic in nature (Figure 10) or has radiating laths of enstatite (Figure 11). The interstices between the silicate grains in the core are filled up by the metallic minerals (Fe–Ni and troilite). The surface generally has troilitic crystallization. These chondrules have the greatest iron-staining (which may be terrestrial) indicating higher sulphide content in the cryptic phase.

The metallic-sulphide phases under polished section consist predominantly of low Ni metallic iron (kamacite) and troilite. Metallic iron has high reflectance and occurs as filling between the silicates (Figure 12). The elongated metallic filling has a rough banded appearance. It rusts rapidly on exposure indicating a low Ni content. Troilite occurs as irregular fillings between grains and on the surface of chondrules. Some chondrules show dispersed microcrystalline metallic grains (Figure 13). The volume percentage of metallic phase in this polished section is 24% (18% metal and 6% sulphide). Sulphides of Ni, Cr, Mn were not detected at microscopic level. Presence of these elements may be in cryptic phase or as replacement of Fe in the metallic phases.

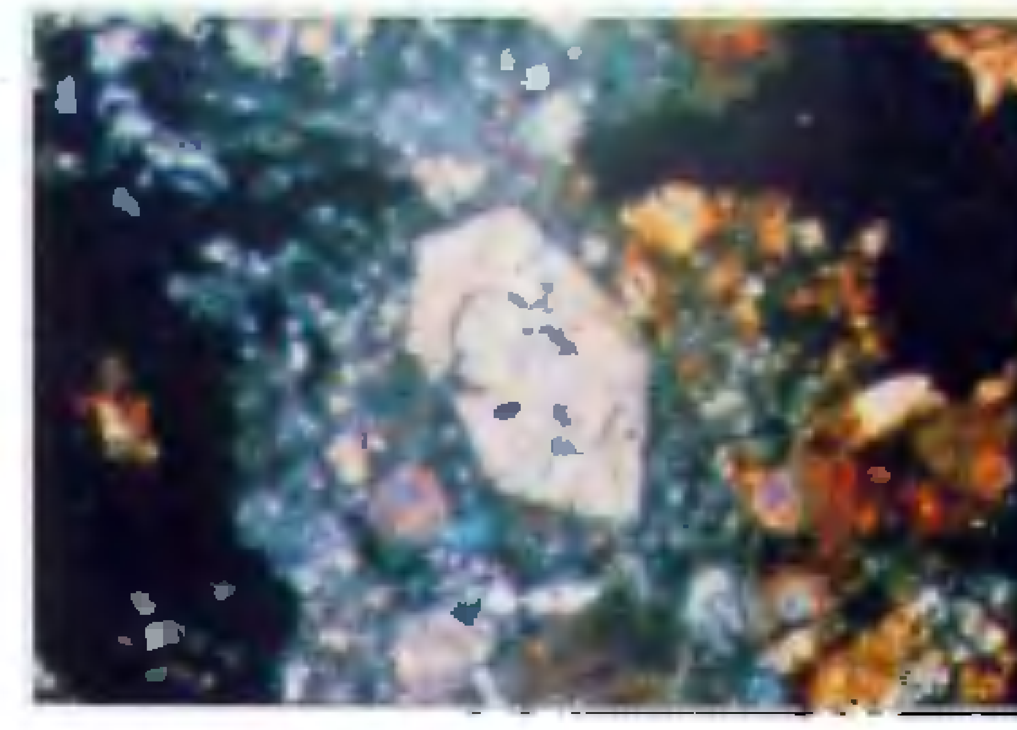

Figure 14. Photomicrograph showing a large olivine grain in fragmental matrix and opaque metallic fillings. (Nicols crossed, Field view 1.1 mm).

Matrix (Figure 14) is devoid of glass and consists predominantly of fragments, native iron, sulphides and recrystallized euhedral grains of orthoenstatite. Matrix consists mostly of clinoenstatite which is clearly a shock-induced inversion showing polysynthetic twinning, and some lamella have extinction angle of 30° (in the region of diopside). Some of the large enstatite grains contain inclusions of isotropic, pink coloured, high refractive index mineral which may be spinel. In some of the grains these inclusions have a ring-like distribution towards the margins of the grain. Olivine is invariably colourless whenever it occurs. Orthopyroxene does not show even a faint pleochroism in the matrix or in chondrules. It must entirely be consisting of Mg-rich end member, orthoenstatite. Tridymite (only one grain was seen) occurs as filling between the enstatite grains. Degraded chondrules commonly contain clinoenstatite whereas undergraded chondrules invariably have orthoenstatite.

Table 1. Chemical composition of the bulk sample and acid-soluble fraction of Didwana-Rajod meteorite (wt %). High Fe extreme of 'E-chondrite' from Mason in Dodd[5] for comparison

Sample/element wt %	Si	Fe	Mg	Na	K	Ni	Remark
DR I Bulk sample	10.1	38.6	5.98	0.48	0.34	2.98	
DR II Acid solution	d	97%	n.d.	n.d.	n.d.	3.2	d (Mn, Cr, Ca, Co, Zn)
E-Chondrite Mason in Dodd[5]	16.47	33.15	10.40	0.75	0.09	1.83	

d, detected; nd, not detected.
Total acid soluble wt % = 32.6%.

Modal (volume) composition of the Didwana–Rajod meteorite is: pyroxenes 63%, elemental iron 19%, troidlite 8%, olivine 6% and others 4%.

Chemical analysis using wet method was done on two samples taking nearly 1 g each. The results are summarized in Table 1. One of the samples was tested for metallic phases by dissolution in dilute hydrochloric acid and the composition of the solution was determined. The other sample was subjected to pyrosulphate-fusion and major elements were determined gravimetrically. Alkali elements were determined by flame photometry. (We do not expect appreciable terrestrial weathering as the meteorite was well preserved and is fracture-free.)

Thus, in the Didwana–Rajod meteorite, the following characteristics are noteworthy:

- The stone is not homogeneous, although inhomogeneity is not very marked. A few creamy-white specs 1 mm to 5 mm in size, one chondrule nearly 7 mm in diameter and a large variation in chondrule variety, represent the inhomogeneity.
- The total acid soluble fraction is 32.6% by weight. Even if up to 5% is deducted for the preferential weathering of metallic fraction (considering that the stone is only 5 years old and well cared in a semi arid climatic zone), the metallic fraction is nearly equal to 31% by weight. The Ni content associated with elemental Fe is low and Mn, Cr, Ca, Si, Co and Zn have yielded positive test in acid-soluble phase.
- Total Fe is more than even the high Fe extreme of E chondrite and is much higher than any other chondrite group[1]. The Fe/Si ratio at 3.8 is also on the high side but Mg/Si ratio at 0.59 compares very well with high Fe 'E chondrites' and is much lower than 'ordinary chondrites' or 'carbonaceous chondrites'. Higher K at 0.34 is enigmatic.
- Chondrules are generally distinct and in abundance putting the meteorite in the petrologic type 3/4 of Van Schmus and Wood (see ref. 6). The glass in chondrules is turbid, suggesting it to be of type 4 category.
- The silicate phase is predominantly free of iron, or has very low Fe content (although precise limits should wait microprobe analysis).
- The predominant silicate phase is enstatite; and its shock-derived clinoderivative is present in the chondrules as well as in the matrix.
- Olivine is substantial (6% volume) and one porphyritic olivine monosomatic chondrule was also seen in the thin sections.
- The matrix is largely fragmental and the absence of turbid glass in it points to some recrystallization.
- There is one grain of tridymite which shows distinct recrystallization in interstices. It coexists with olivine.
- Elemental Fe is filling up the spaces between grains in the area showing poorly-developed bands in the meteorite.
- Chondrule crystallization is highly variable, ranging from cryptic to porphyritic with feathery crystallization occupying the middle part.

Enstatite chondrite according to Mason[1], Keil[2] and Wasson[3] is a group of relatively rare meteorites. They were thought to be totally devoid of glassy chondrules and olivine. However, every new fall or find of uncommon meteorite adds to the existing range of characteristics of that group and leads to formation of subgroups[4,5]. Hutchison[4] gives a general picture of E-chondrite composition as: enstatite 65%, kamacite 15%, troilite 10% and plagioclase 5%. Out of the 20 falls or finds reported, 6, 2, 10 and 1 meteorites belong to Van Schmus and Wood's[6] petrological types 4, 5, 6 and 7 respectively, leaving one enstatite chondrite unclassified[4].

Coming to the Didwana–Rajod meteorite, it has all the petrologic characteristics of an enstatite chondrite of type 4 of Van Schmus and Wood[6] with high iron. However, it contains olivine in crystalline phase, tridymite coexisting with it and shows no recognizable plagioclases. On the basis of bulk-chemistry and petrography, it may be put in E-chondrite group type 4. Bhandari *et al.*[7] have reported Parsa meteorite (belonging to E-chondrite type 4) as containing a higher olivine content as compared to the other meteorites of the subgroup. The Didwana–Rajod meteorite, besides this, contains glassy chondrules.

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B. S. PALIWAL
V. K. VAYA
D. S. CHAUHAN

Department of Geology,
J. N. V. University,
Jodhpur 342 005, India