THE MARILIA METEORITE SHOWER – A PRELIMINARY REPORT

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The fall of a meteorite shower in Marilia, Sao Paulo State, Brasil, is announced. An individual specimen is macroscopically described in some detail. The X-ray diffraction analysis shows it to be an olivine-bronzite chondrite or group H4 classification.

INTRODUCTION

At about 5 p.m. local time on October 5, 1971, a shower of meteorites fell near Marilia, Sao Paulo State, Brasil, Fig. 1. The coordinates of the fall site are lat 22° 15′ S.; long 49° 56′ W. The phenomenon was observed by many witnesses. Among them was one of us (P.E.A.), who personally collected some individual specimens. The total weight of the recovered fragments was estimated about 2.5 kg.

The largest mass is preserved in the Universidade Federal of Bahia: it is a roughly pyramidal individual, weighing 780 g and partially coated by a dark fusion crust.

A smaller individual, see Fig. 2, weighing 106 g, was made available for research. Material from this specimen was divided between two groups of research workers: G. R. Levi-Donati and G. P. Sighinolfi of Italy and D. Nordemann and T. Sakai of Brasil. Detailed investigations are in progress. Nordemann and Sakai (1973) are publishing a report on the activity of the radionuclides measured by gamma-ray spectrometry. The results of the chemical analysis (analyst: G. P. Sighinolfi) will be given soon elsewhere. Some macroscopic features and a preliminary characterization are here briefly summarized.

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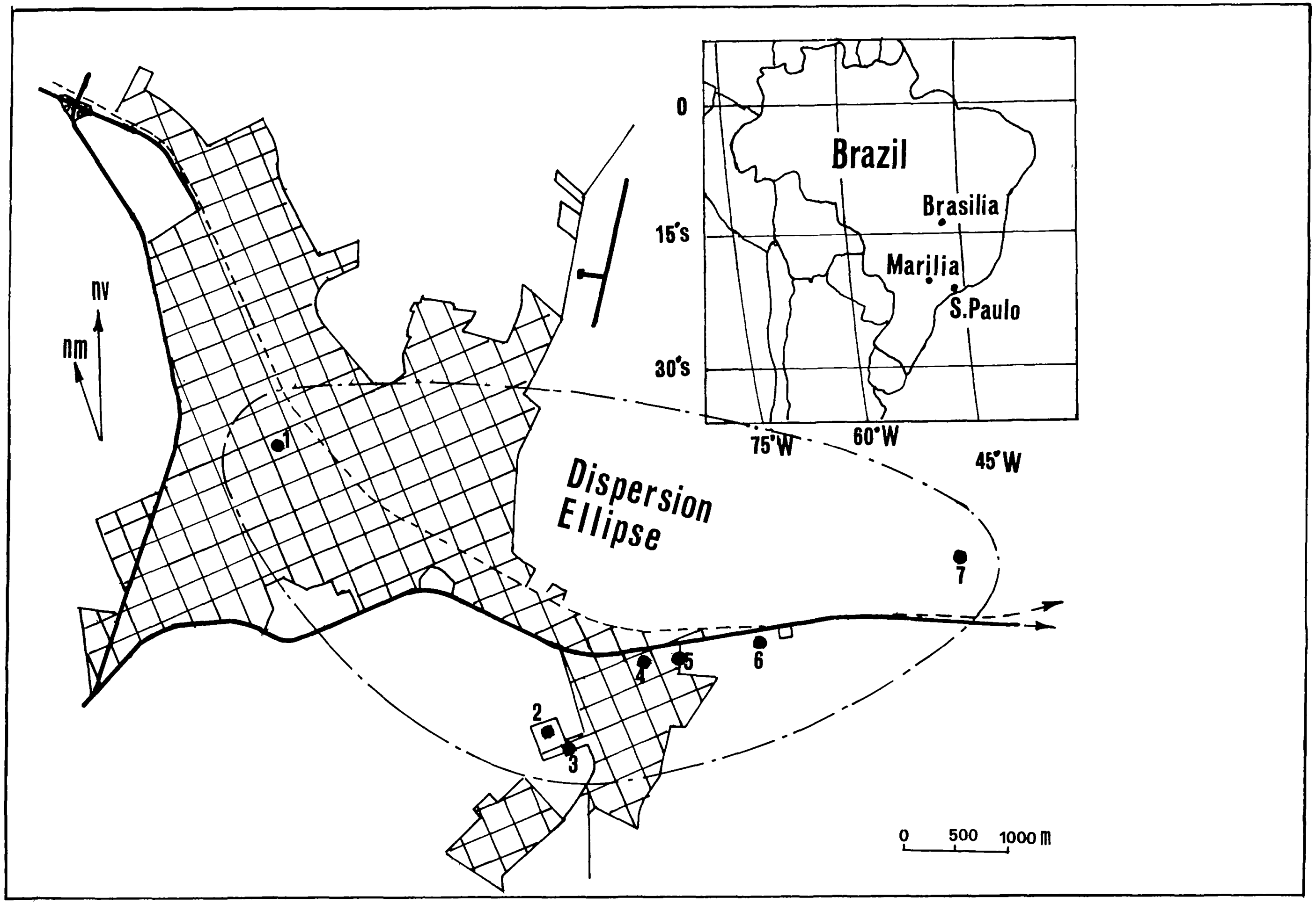

Fig. 1 Map showing the sites (1,2,3,4,5,6 and 7) where the Marilia meteoritic stones fell and were immediately recovered.

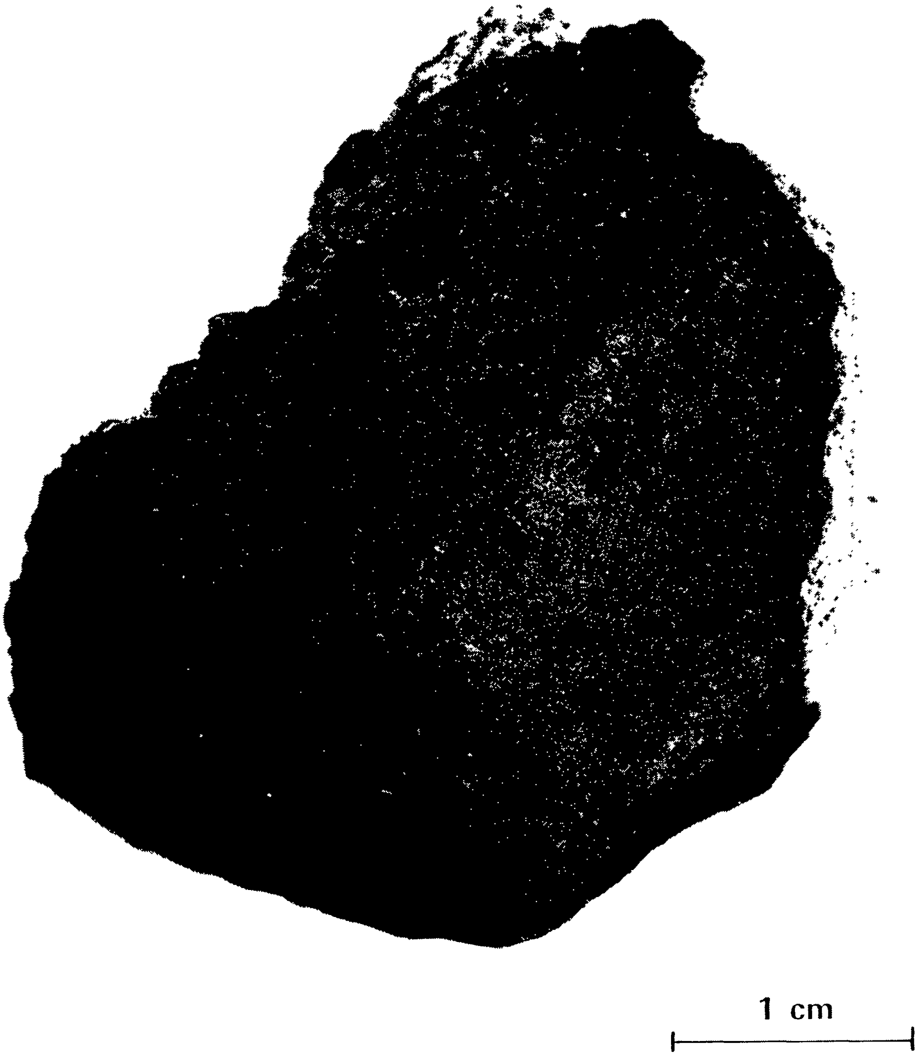

Fig. 2 **The Marilia meteoritic shower: individual specimen weighing 106 g.**

MACROSCOPIC FEATURES

As Fig. 2 illustrates, the individual specimen examined for this report exhibits a defined form of trilateral pyramid, with well-rounded corners and smooth edges. Such peculiarities of form are characteristic of a 'semi-oriented' sample (Krinov, 1960), and lead us to assume that, 1) the fragmentation of the original body may have happened at considerable altitude, say at least 15 km, and 2) our individual specimen probably continued to move at cosmic speed and maintained the same direction during the trajectory in the lower parts of the retardation region.

The crust is uniformly dark gray in color. Its thickness is variable: at some points it reaches 2 mm, while in others it is thinner than 0.3 mm.

Following Krinov (1960), these data should be connected with the mineralogical composition and structure of the extraterrestrial sample. In our particular case the mass is lithic in composition and shows a fine-grained structure. Regmaglypts or veins are not clearly visible. The specimen does not exhibit evidence of weathering.

MICROSCOPIC CHARACTERIZATION

The following preliminary observations on mineralogy and texture have been performed by optical microscopy.

The Marilia meteorite is principally composed of olivine, pyroxenes, nickel-iron and troilite. Minor constituents including plagioclase and chromite are present and microscopically distinguishable.

Olivine is frequently found in idiomorphic euhedral and subhedral crystals which often show irregular and regular fractures. An X-ray diffraction analysis, utilizing the method of Yoder and Sahama (1957), gave for this mineral 20 mole percent fayalite.

Pyroxenes are also abundant and occur mainly as rhombic prismatic crystals. However it can be noticed that at least one third of the

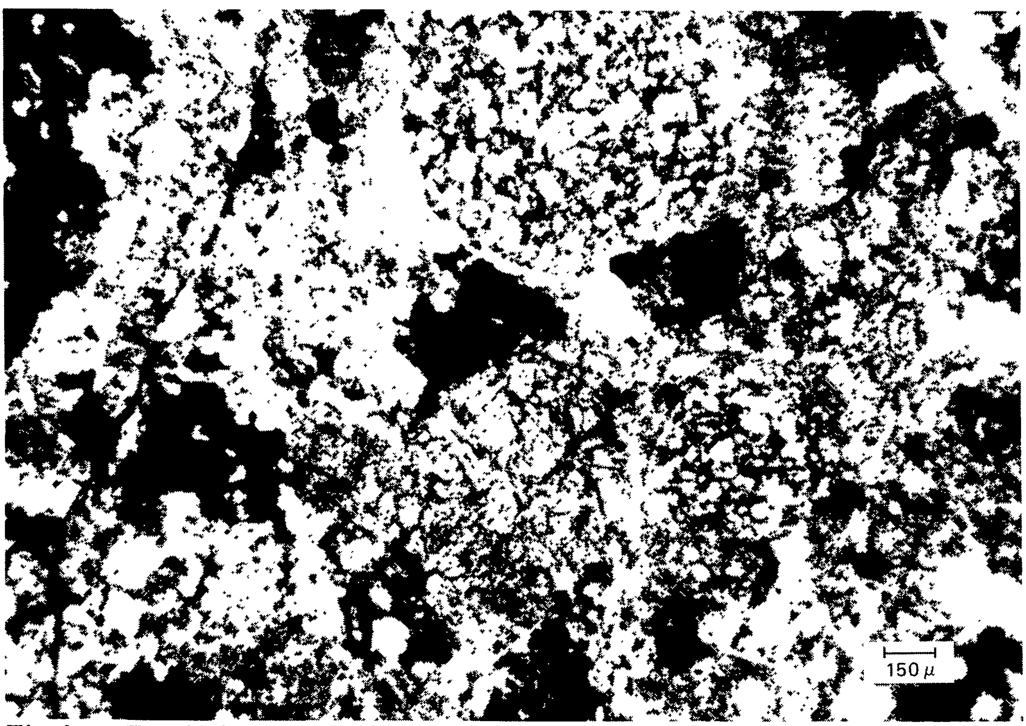

Fig. 3 The highly chondritic texture of the Marilia meteoritic shower; in the left corner a metallic veinlet is noticeable.

(ordinary light)

well-developed grains are represented by the monoclinic variety. In this case the grains show fine lamellar twinning. The determination of the refractive indices indicates an average content of Fs = 17 mole percent. These values are consistent with an olivine-bronzite classification.

Nearly all of the plagioclase grains are crystalline and virtually no maskelynite is present in our sections. The mineral occurs as very small (<20 μm) interstitial grains.

The opaque components are often present in amoeboidal forms, the large grains showing corroded edges. Veinlets, as in Fig. 3, droplets and some fine dusty inclusions were also noticed. In reflected light the nickel-iron appears distinctly white, while the iron sulphide is recognizable by the characteristic bronze-yellow color. Some tiny grains of chromite and of an unidentified mineral, with reddish-brown inner reflection and high reflecting power, were noted.

The texture of the Marilia meteorite is highly chondritic, as Fig. 3 illustrates. Our stone contains most of the common kinds of mono- and polysomatic chondrules found in meteorites. Porphyritic, fibrous, barred or granular in structure, these chondrules often show well-defined contours, as shown in Fig. 4. Metallic rings are notable. The matrix is fundamentally fine-grained and occurs as interstitial aggregates between chondrules.

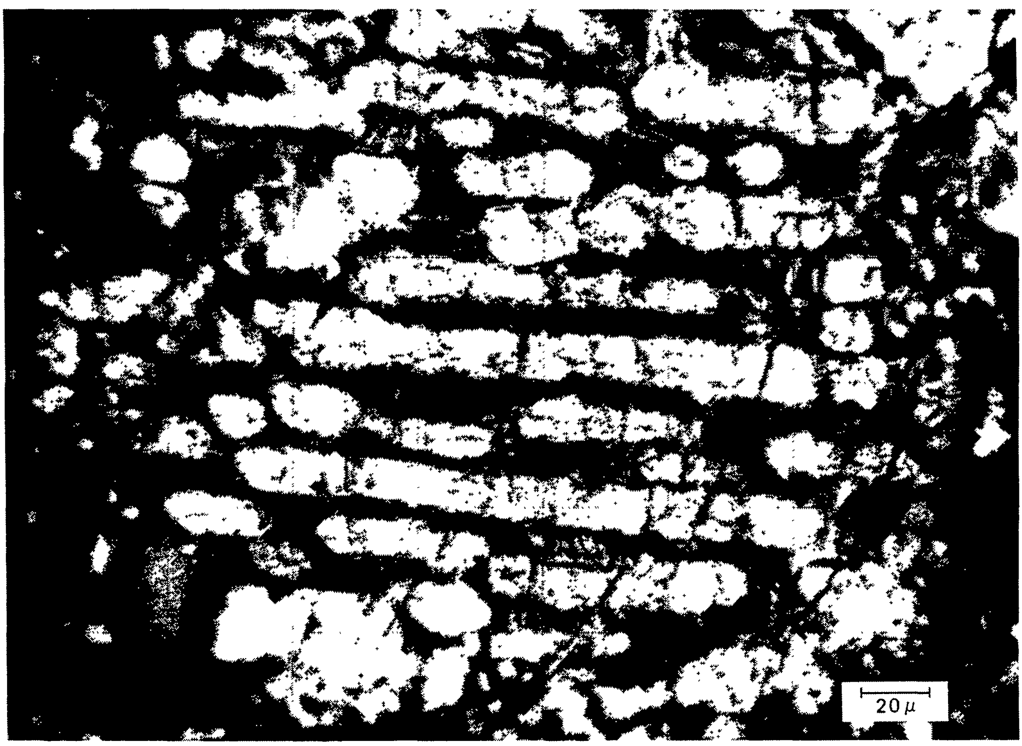

Fig. 4 High magnification of a 'barred' olivine chondrule.

(crossed polars)

CLASSIFICATION AND CONCLUSIONS

On the basis of our determinations, the Marilia meteorite is classifiable in the high-iron H group chondrites of Urey and Craig (1953), and it may be placed in the petrologic type 4 of Van Schmus and Wood (1967).

The stone was also inspected for those metamorphic features which are usually ascribed to shock induced alterations. As a matter of fact we did not notice in the texture of Marilia evidence of shock metamorphic products nor of peculiar microdeformations. This finding may be considered in some way as a new confirmation of the Anders (1964) and Heymann (1967) shock theory. As these authors emphasized, the hypersthene chondrites, as contrasted with the bronzite chondrites, were probably involved in a severe cosmic collision some 520 ± 10 m.y. ago. Therefore, as is perhaps predictable, the results of our inspection are in agreement with the original hypothesis. In light of our present knowledge we may then conclude that the clastic phenomena observed in the microtexture of the Marilia meteorite may be attributable to some temperature-pressure disequilibria induced in the stone during the long extraterrestrial journey.

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