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THE EL PASO METEORITE

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INTRODUCTION AND DESCRIPTION

The El Paso Meteorite is a medium grained, olivine-hypersthene, L 4, chondrite. It was found by W. S. Strain on February 18, 1950 about 25 miles east of the City of El Paso, Texas, at approximately lat 31°47′ N.; long 106°14′ W. The name is derived from El Paso, Texas, the closest town whose name is not occupied by a previously described meteorite. The specimen weighed 275.98 grams at recovery. The degree of oxidation of the fusion crust and a recently broken surface suggest that it probably fell a decade or more before it was recovered. The main mass of the meteorite is now in the permanent collections of the Department of Geological Sciences, The University of Texas, El Paso.

The specimen was found on the surface in an area of sand dunes. A careful search of the locality failed to reveal other fragments. It was discovered about fifty yards from a ranch road which is frequently used by artifact hunters. It is possible that someone found the meteorite at another locality and, believing it to be a rock blackened in a kitchen midden, cast it aside after carrying it some distance from the point of discovery.

The general shape of the meteorite is prismatic and resembles a loaf of bread cooked in a narrow pan in which it rose and slightly overhung the rim. Its approximate dimensions are 66 mm by 45 mm by 31 mm.

All but one surface is covered by fusion crust and shows clearly that the specimen was broken after the meteorite was well within the earth's atmosphere, probably on impact or thereafter. A circular depression on the fused surface is 5 mm in diameter and probably marks a site where a chondrule was dislodged prior to the development of the fusion crust. The fusion crust is Class I, Type 2, Nodular (Krinov, 1960). The crust is brownish black and displays a network of fine cracks which may be contraction fractures.

PETROGRAPHY AND CHEMISTRY

A freshly cut surface of the meteorite reveals bright metallic particles over approximately 12 per cent of the entire area. The particles range in size from a small fraction of a millimeter to 1.5 mm. Chondrules are abundant and

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the sizes range from 0.1 mm to 8.0 mm with an average of approximately 1.0 mm. Chondrules make up about 65 per cent of the meteorite.

Based on structure and mineralogy, four varieties of chondrules can be distinguished. Prismatic crystals of olivine are the most common: 52 per cent. Most of these are neither spherical nor show as sharp boundaries as the other types of chondrules. Less abundant, and generally smaller, are the single-crystal chondrules of subhedral to almost euhedral olivine. This variety accounts for about 8 per cent of the chondrules. The third type is composed of well-rounded and sharply-bounded chondrules composed of radiating fibers of orthopyroxene. In some cases, these orthopyroxene chondrules are surrounded by a rim of granular olivine. Present in some of these larger chondrules are apparent exsolution textures in the orthopyroxene; the exsolution mineral probably represents diopside (?). Radiating prisms or plates of coarser orthopyroxene make up the fourth variety of chondrule. The fiberous and prismatic orthopyroxene varieties comprise 19 per cent and 21 per cent respectively of the chondrules.

The olivine and orthopyroxene chondrules are surrounded by anhedral crystals of Ni-Fe, troilite, olivine, pyroxene, and some oligoclase plagioclase.

MINERALOGY

The most abundant minerals in the El Paso Meteorite are olivine and orthopyroxene. These minerals occur predominantly as chondrules, but also are observed as smaller anhedral forms surrounding the chondrules.

Next in abundance are the Ni-Fe compounds of kamacite and taenite followed by troilite and plagioclase feldspar with minor amounts of graphite, possibly maskelynite and micro crystalline devitrified glass and a secondary product of iron oxide.

Shown in Table 1 are the modal and normative minerals of the El Paso Meteorite. In general, agreement is good between the normative and modal minerals except for plagioclase, which is much more abundant as a normative mineral.

Olivine is the most abundant mineral in the meteorite and comprises 48 per cent of the modal and 43 per cent of the normative determinations. The composition of the olivine, determined by X-ray diffraction, is $Fa_{28} \pm 0.6$ (Moore, written communication, 1970); this compares with the normative calculation of Fa_{33}.

Pyroxene is predominantly represented by orthopyroxene, but in some orthopyroxene chondrules, exsolution textures indicate the presence of an exsolved clinopyroxene. The high calcium content of orthopyroxene suggests that this exsolved phase is a calcium-rich pyroxene, possibly diopside. The

TABLE 1
Mineralogy of the El Paso Meteorite

Modal Minerals		*Normative Minerals*	
Olivine	48%	Olivine (Fa_{28})	42.8%
Pyroxene ("hypersthene")	34%	Pyroxene (Fs_{26})	34.2%
Plagioclase (oligoclase plus maskelynite)	2%	Plagioclase (An_{30})	10.0%
Opaques (troilite, kamacite, taenite, & graphite)	13%	Kamacite & Taenite	5.0%
Secondary (iron oxide)	3	Carbon	1.0%
		Troilite	6.7%
		Merrilite	0.3%
	100%		100.0%

TABLE 2
Chemistry of the El Paso and Olivine-Hypersthene Meteorites

Oxide	*El Paso Meteorite*[1] *(weight per cent)*	*Olivine-Hypersthene Chondrite*[2] *(weight per cent)*
SiO_2	39.14	39.93
NiO	0.63	--
MgO	24.76	24.71
FeO	14.41	15.44
Al_2O_3	2.56	1.86
CaO	3.09	0.74
K_2O	0.03	0.13
Cr_2O_3	0.76	0.54
MnO	0.33	0.33
TiO_2	0.09	0.14
P_2O_5	0.22	0.31
Fe	4.96	6.27
Ni	0.22	1.34
Co	0.02	0.05
C	0.99*	0.03
FeS	6.88	5.89
	99.09	99.67

1 Analyses by Booth, Garrett, and Blair, Inc., Ambler, Penn.
2 Mason, Brian, 1962
* C. B. Moore, Arizona State University, determined the carbon in another specimen of the El Paso Meteorite and found 0.55%. The high value of 0.99% may include contamination by organic compounds in the cutting fluid.

orthopyroxene has a 2V of approximately 70° and is magnesium-rich. Normative calculations give a composition of Wo_{13} Fs_{27} En_{60}.

Plagioclase is present as small subhedral to euhedral crystals with composition of approximately An_{28}, calcic oligoclase; normative plagioclase has a calculated composition of An_{30}. There is a rather large discrepancy between the normative (10 per cent) and modal amounts (2 per cent) of plagioclase. However, Mason (1962, p. 226) reports that this difference is quite common.

Kamacite and troilite occur as massive anhedral forms interstitial between the chondrules. Both were identified by X-ray powder patterns, but a positive identification of taenite has not been made. Graphite(?) is found in amounts of less than 1 per cent.

Iron oxide is present as an alteration product of the iron compounds. It forms around the kamacite and also as coatings in fractures in the pyroxene and olivine; the total percentage of iron oxides is about 3 per cent.

Chemically, the El Paso Meteorite can be classed as an olivine-hypersthene chondrite, comparing very closely to the chemical analysis typical of such a chondrite as shown in Table 2. Notable exceptions exist, however, such as the much higher Ca0 and C content and lower amount of Fe and Ni in the El Paso Meteorite.

On the basis of both mineralogy and chemistry, the El Paso Meteorite falls within the limits of variation for the olivine-hypersthene chondrites, as shown in the following table. All figures are in weight percent except Fe0/Fe0 + Mg0 which is in mole percent (Mason, 1962).

TABLE 3

Comparative Mineralogy of the El Paso and Olivine-Hypersthene Meteorites

Minerals	*El Paso Meteorite*	*Olivine-Hypersthene Chondrites**
Pyroxene	34.5 (Fs_{26})	25-35 (Fs_{20-30})
Olivine	42.7 (Fa_{28})	35-60 (Fa_{22-23})
Ni-Fe	5.2	1-10
Oligoclase	10.0*	5-10
Troilite	6.9*	5
Total Fe	20.4	20-30
Fe0	13.8	12-23
Fe0/Fe0 + Mg0	24.0	22-32

*Normative

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