THE KIRBYVILLE EUCRITE

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ABSTRACT

The Kirbyville eucrite fell on November 12, 1906 at about 15:30. The single known specimen of 94.6 g, covered with a black fusion crust with conspicuous flow lines, has a general pyramid shape. The heavily twinned pyroxenes range from En30 Fs29 Wo41 to En38 Fs61 Wo2, and the plagioclases range from Ab14 An86 to Ab8 An92. Modal analysis gives (in weight %) pyroxene 58, plagioclase 37, silica 3 and opaques 2. The Kirbyville is classified as a non-cumulate, ~~monomict~~ eucrite belonging to the Main Group eucrites.

tautology

INTRODUCTION

The Kirbyville meteorite fell near a farm house on November 12, 1906 at about 15:30 in Jasper County, Texas (the approximate coordinates: 30°48'N, 93°56W). The fall was observed by at least three members of the resident family who heard a strange noise, saw a stone fall and immediately recovered the stone embedded about 3 inches in loose sand. The stone remained in the family of Mr. Thomas W. Morgan until Mr. Oscar Monnig obtained the only known specimen of the fall

received 20 August 1987

in 1934. Originally the specimen weighed 97.7 g, but subsequent chemical analysis and probe investigations have reduced the specimen to 94.6 g.

The Kirbyville meteorite has been mentioned ~~in several papers, including~~ by Mason et al. (1979), and Heymann et al. (1968). Heymann et al. (1968) dated Kirbyville, determining a K/Ar age of 3.2 b.y. and a U/He age of 4.5 b.y. The cosmic ray exposure of 14.9 m.y. is slightly younger than the average exposure age of 20.6 m.y. for all of the eucrites studied by Heymann et al. (1968).

SPECIMEN DESCRIPTION

The single known specimen (Fig 1) forms a distorted 4-sided truncated pyramid 3.5 cm high with a 4x4 cm base. The truncated top surface is slightly concave, rectangular in shape, measuring about 2.5x2.5 cm, and is marked by small pits. The specimen is generally covered with a glistening, black fusion crust that is dimpled with small depressions. Radial melt lines originate from a small central knob at the base, ~~where the~~ with thinnest fusion crust ~~is thinnest~~, and flow over the sides toward the truncated top, where the crust is thickest. These flow lines suggest that the base was facing forward in flight, with the truncated top toward the rear. Two adjacent sides of the pyramid are roughly perpendicular to each other, and to the top, and the base. The other two adjacent sides join as a gentle curve, ~~forming an obtuse angle with the truncated top.~~ Small patches of fusion crust with some of the interior are

not really necessary

absent along two edges of the base, perhaps lost during atmospheric entry. Material to be used for probe sections was cut from one corner of the pyramid.

~~Under a binocular microscope at 15x magnification,~~ thin cracks (how wide and how long?) forming irregular polygons in the black fusion crust ~~are visible.~~ This likely resulted from cooling of the crust after atmospheric entry and before impact? Numerous yellowish to brown globules discolor the otherwise black fusion crust. The interior on a fresh cut surface is generally gray in color and ~~shows~~ has conspicuous dark clasts and ~~unhealed~~ fractures ~~lines.~~

Remember that the crust formed after atmospheric entry & before impact.

~~Inspection of the probe~~ In this section ~~using a petrographic microscope revealed~~ distinct clasts ~~ranging from~~ 1-8 mm in diameter with Subophitic textures of both fine and coarse grains ~~in different clasts~~ are readily visible. The coarser-grained subophitic texture has euhedral plagioclase lathes up to 0.8 mm long (Fig 2A). The interstices are filled with pyroxene crystals that are optically continuous in discrete patches. poikilitic? rather than subophitic

Clasts ~~with non-ophitic textures contain sporadic~~ Irregular mineral clasts of subhedral to anhedral plagioclase and pyroxene crystals up to 0.4 mm occur in a fine grained matrix of the same minerals (Fig 2B). The pyroxene is intensely twinned with closely spaced lamellae that are < 1 mm in width. should have been ~~5~~ microns The section contains much evidence for brecciation: fractures (Fig 2C), clast outlines (Fig 2B), mosaic and undulatory extinction in the pyroxene and plagioclase crystals, and warping of the polysynthetic twins in the

is this clinopyroxene pigeonite or augite?

crystals up to 0.4 mm cannot contain lamellae < 1 mm
Scales need to be reconciled!

plagioclase and pyroxene. No evidence for recrystallization after brecciation was observed.

ANALYSIS

Electron microprobe analyses were made on the minerals using an ARL EMX-SM at 15 Kev and with a 20 nA sample current. The ~~almost universally~~ fine twinned pyroxenes have a ~~compositional~~ range ~~of~~ from Wo_{2-41}, Fs_{27-61} and En_{30-40} (N = 28) with most of the points centered around Wo_8, Fs_{56}, and En_{36} (Fig 3). The Wo and Fs tend to vary inversely, but the En is more constant, indicating equilibrium crystallization of inverted pigeonite. The plagioclase composition has a range of An_{86-92}, (N = 12) with an average of An_{89}. No significant compositional variations were noted between different points on a given plagioclase grain. Point counts show that the meteorite consists of 2 wt % opaque minerals with a predominance of ilmenite, lesser magnetite, and one grain of chromite. There is also a small quantity of a silica phase (tridymite or cristobalite) seen by the probe.

Mason et al. (1979) gave a bulk chemical analysis of Kirbyville (in weight percent) SiO_2 49.8, TiO_2 0.67, Al_2O_3 11.9, Cr_2O_3 0.40, FeO 18.7, MnO 0.54, MgO 6.96, CaO 10.0, Na_2O 0.45, and from this analysis, calculated the mineral weight percentages: plagioclase, 34, pyroxene, 59 and silica, 4.1. A modal point count performed on the probe section for this paper gave (in wt %) plagioclase 37, pyroxens, 58, silica 3 and opaques 2.

CONCLUSIONS

The Kirbyville meteorite is a non-cumulate monomict eucrite as originally described by Mason et al. (1979). The plagioclase has a mean composition of An 89 and the pyroxene ranges in composition from Wo 2 Fs62 En36 to Wo 41 Fs27 En32. Also present are silica and ilmenite with traces of magnetite and chromite.

Using the chemical analysis given by Mason et al. (1979), the Kirbyville meteorite is a "Main Group" eucrite with a calculated molar Mg/Mg + Fe value (x 100) of 39.9 and Ti value of 0.4mg/g (Warren and Jerde, 1987). In texture, optical properties and composition, Kirbyville is similar to the eucrite, Juvinas. The plutons suggest that Kirbyville looks like Lakangaon or Nuev. Laredo, Not Juvinas.

ACKNOWLEDGEMENTS

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Fig. 1 Top view (A) and bottom view (B) of the Kirbyville eucrite. View (A) shows the truncated top with the pyramid sides covered with fusion crust. View (B) shows the well-developed flow lines radiating from the center of the base and the areas of missing crust uncovering the light colored interior.

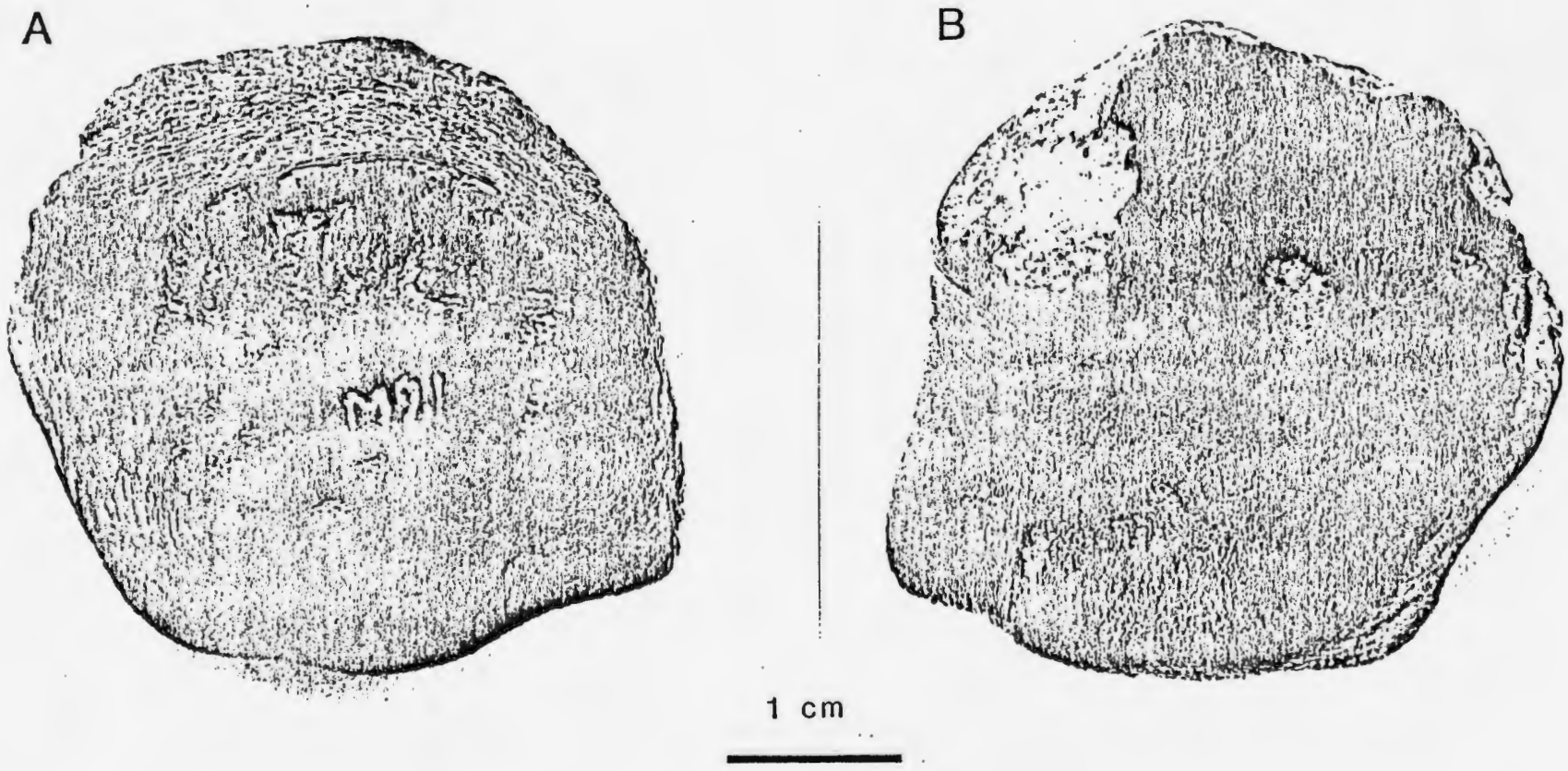
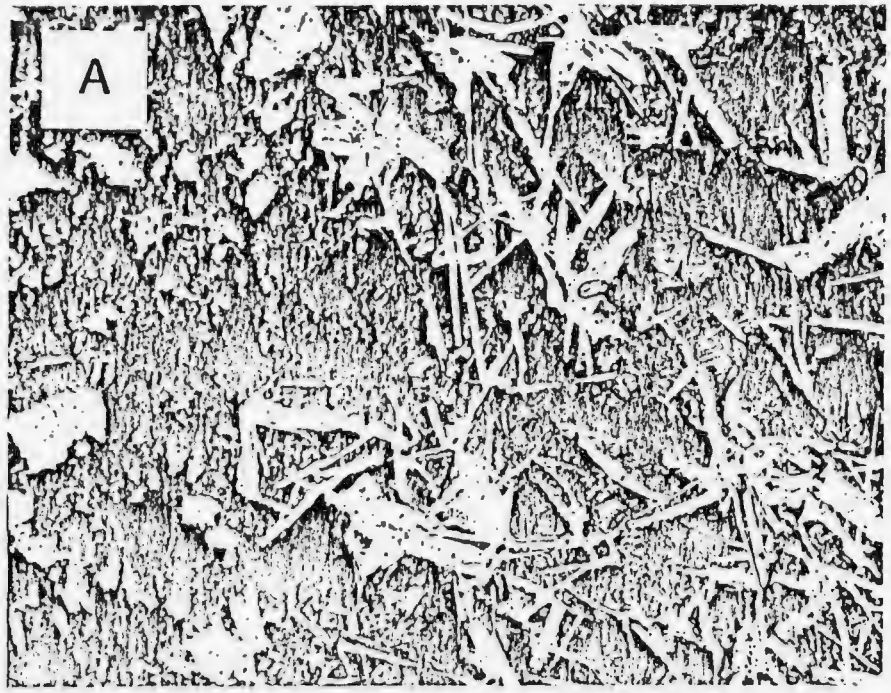

A
B
1 cm

Fig. 2 Photomicrographs of the Kirbyville probe section under cross-polarized light. A) subophitic texture; B) brecciated texture; C) fractures crossing the length of the photo. Bottom edge = 3.5 mm on all photos.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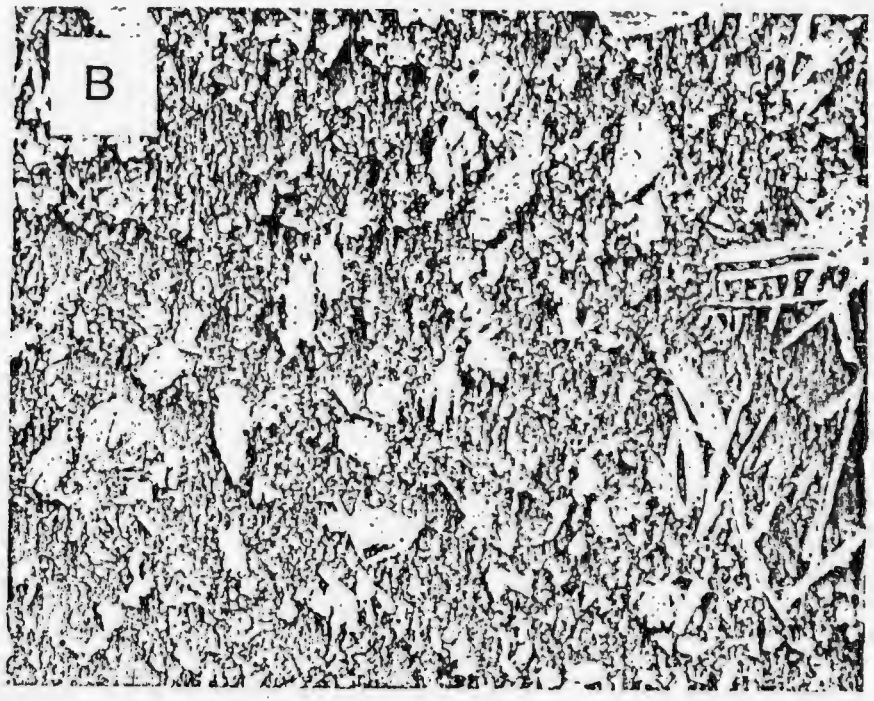
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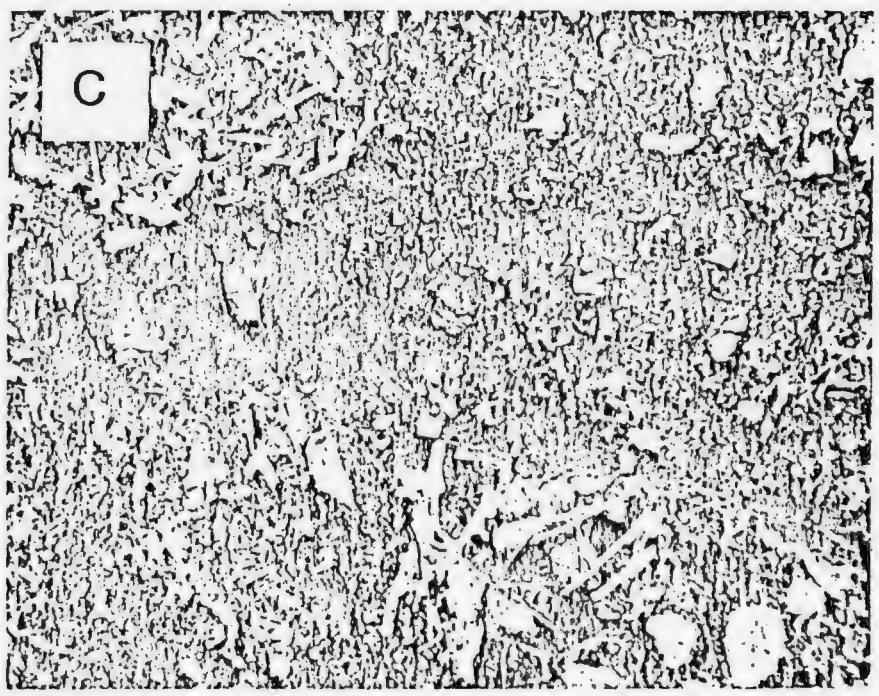
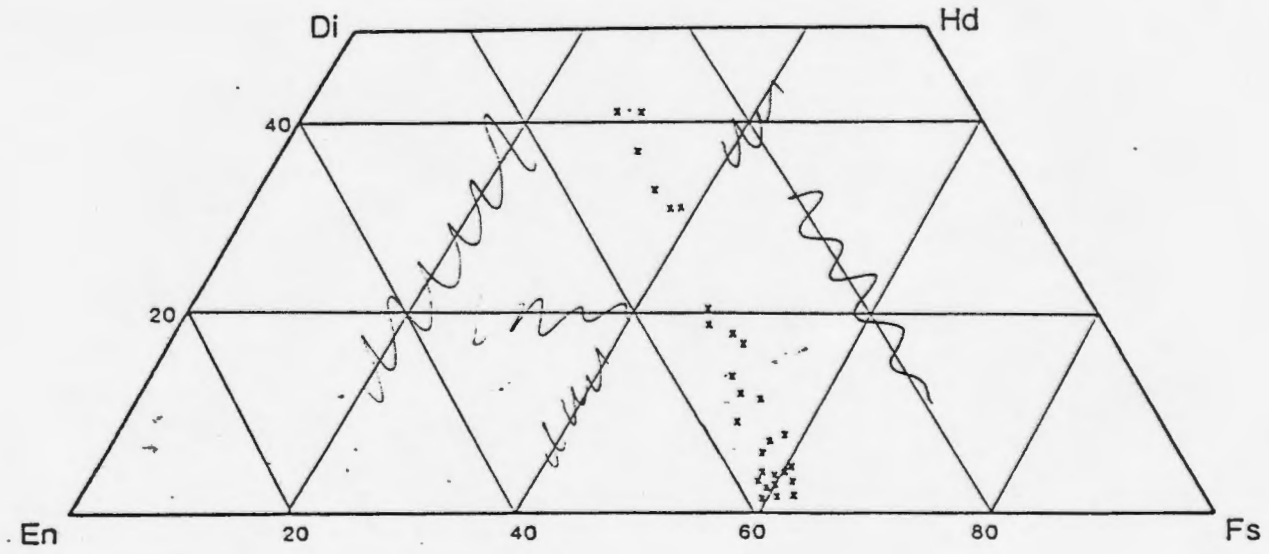

C

Fig. 3 Plot of pyroxene data points from microprobe analyses on the Kirbyville eucrite.



Remove internal lines
leave only V or < or > ticks
of edge of pyroxene quad.