BASALTIC LUNAR METEORITE EET96008 AND EVIDENCE FOR PAIRING WITH EET87521.

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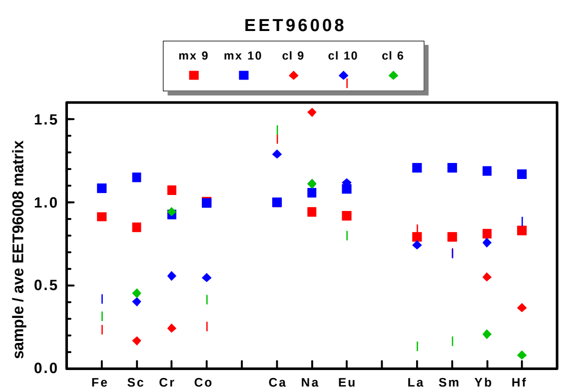
Introduction. Elephant Moraine 96008 (EET96008) is the newest Antarctic lunar meteorite. It is a 53 g basaltic breccia that was collected in the Meteorite City icefield of the Elephant Moraine region. It is generally similar to EET87521, the first basaltic lunar meteorite[1,2], which was recovered from the same icefield. This lead us to investigate the possibility of paring of the two meteorites.

Samples and Analyses. We were allocated a thin section (,36) and three chips of EET96008. One chip (,6) was dominated by a white clast. The other chips (,9 ,10) were mostly matrix with small light colored clasts. We separated matrix and individual clasts from both chips. The 3 clasts and 2 matrix samples were analyzed by INAA for their major and trace element compositions. We plan to perform backscatter and elemental scans of the thin section and measure mineral compositions using the electron microprobe.

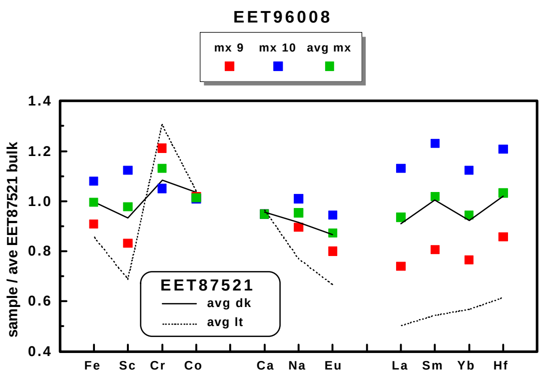
Petrography. Examination of thin section EET96008,36 show it to have a complex microbreccia texture. Clasts of pyroxene, plagioclase, olivine and opaque minerals are abundant and vary widely in size. Most of the larger pyroxenes are brown pleochroic grains. Most of the large plagioclase grains are moderately shocked. Lithic clasts are less common than single grains and include coarse grained gabbros, granulitic breccias, and impact melts. The matrix consists of comminuted minerals and glass in varying proportions, with dark matrix rich in glass and light matrix poor in glass. There are some larger patches of pure glass, but no glass spheres were found.

Bulk Composition. The compositions of EET96008 matrix and clasts are shown in Figure 1 where they are normalized to average matrix. The elements shown are grouped geochemically as ferromagnesian elements which are found in mafic silicates and oxides, Na, Ca and Eu which concentrate in feldspar, and incompatible elements which are found in igneous residual liquids and the enigmatic lunar KREEP. (Only one sample, clast 10, had measurable quantities of the siderophiles Ir and Ni.) The two matrix samples have distinct compositions which differ by typically 10-20%. Matrix ,10 is richer in Fe, Sc, Na, Eu and incompatible elements, and poorer in Cr than matrix ,9. If these compositional variations are due to simple mixtures of basalt and glass, and the basalt component is like the clasts we studied, then the glass is rich in later crystallizing ferromagnesian and incompatible elements. This glass may thus be derived from a moderately evolved basaltic liquid. Alternately the matrix may be a more complex



mixture of primitive Cr-rich basalt, evolved Fe-rich basalt, KREEP and maybe other components.

The matrix samples are more similar to each other than to any of the clast samples. The clasts, which were selected because they were lighter in color than the matrix, are all less mafic (lower transition element contents) than the matrix. They vary widely in composition with variations due to heterogeneous distribution of minerals from the basaltic precursor(s). The clast with the lowest incompatible element contents has the highest Cr content. This suggests that it could be derived from a more magnesian basalt. Further analyses of major elements (Mg, Al) and mineral compositions are required to evaluate these variations in clast and matrix composition.



Discussion. Because EET96008 and EET87521 are basaltic lunar meteorites recovered a short distance apart, there is a good possibility that they are paired. Comparison of their petrography and geochemistry provides a test of that pairing. We compared the textures of three thin sections of EET87521 with that of EET96008. All samples are very similar microbreccias showing light and dark areas of matrix, glass, and mineral and lithic clasts of widely varying sizes. Photos of comparable areas in EET87521 and EET96008 show that while each breccia is heterogeneous, their variations cover similar ranges. This is also true of mineral compositions taken from the literature [1, 2, 5].

Comparison of the compositions of matrix samples of EET96008 and EET87521 is even more conclusive. Figure 2 shows various matrix samples of both breccias normalized to the average of two bulk analyses of EET87521 [1] based on 578 mg of breccia. The average of matrix analyses for EET96008 is essentially identical to the average EET87521 dark matrix, and very similar to the average of bulk analyses of EET87521. As noted above and previously [3], both breccias exhibit significant variations in matrix composition. Figure 2 shows that these variations are parallel in the two breccias. EET96008, 9 is generally similar to EET87521 light while EET96008,10 shows some similarity to EET87521 dark [3, 4]. Of particular note is the inversion of these patterns at Cr. The compositional data for EET87521 samples are more complete and show that light matrix is a more magnesian (primitive) sample. This supports that suggestion that variations in EET96008 noted above are in part due to variations in proportions of primitive and more-evolved basaltic samples. These geochemical comparisons between the two breccias show that not only are their average compositions nearly identical, but their internal variations follow similar patterns. This strongly supports the pairing of the two samples. The final evidence for pairing must come from other studies because exposure histories of the two samples must be compatible for paired meteorites. This is indeed the case as is reported by Nishiizumi [6]. There is little room for doubt that the two meteorites are paired specimens.

References. 1) Warren P.H. and Kallemeyn G. W. (1989) GCA 53, 3323-3330. 2) Delaney J.S. (1989) Science 342, 889-890. 3) Lindstrom M.M. et al (1991) LPSC XXII, 817-818. 4) Dreibus G. et al (1991) LPSC XXII, 325-326. 5) Mason B. (1998) Ant. Met. News. V21-1. 6) Nishiizumi K. (1999) LPSC XXX, this volume.