CONSTRAINTS ON THE HIGHLANDS SOURCE-AREA OF LUNAR METEORITE ALHA 81005 USING CHEMICAL COMPOSITIONS OF GLASSES. J. W. Delano, Department of Geological Sciences, State University of New York, Albany, NY 12222.

INTRODUCTION

In an accompanying abstract [1], data are presented supporting the hypothesis that lunar impact glasses have chemical compositions (among refractory lithophile elements) that are equal to that of the fused targets. Although the bulk composition of ALHA 81005 is representative of <u>one</u> regolith, the impact glasses contained within that one breccia were produced by impact melting of <u>many</u> regoliths exposed throughout in that region of the Moon. If the highlands regolith is compositionally variable in that area, the impact glasses should record it. In this study, a large suite of impact glasses in ALHA 81005 have been analyzed by electron microprobe.

RESULTS

The impact glasses in ALHA 81005 exhibit a systematic range of compositions among the refractory lithophile elements that overlap that of the bulk sample. Since the impact glasses exhibit fractional losses of Na, K, and Si [2-4], meaningful comparisons require the use of refractory lithophile element ratios (Ti/Al/Fe/Mg/Ca). For example, Figure 1 shows that the impact glasses define a prominent trend that approximates two-component mixing between a plagioclase-rich component (e.g. anorthosite) and an Mg-rich component (e.g. norite, troctolite). The bulk composition of ALHA 81005 [5-8] is located near the middle of this trend. The atomic Ca/Mg ratio of the Mg-rich component (Figure 1) defined by the impact glasses in ALHA 81005 is 0.038 ± 0.001 compared to a value of 0.120 ± 0.001 defined by regolith at Apollo 16. This indicates that the mafic component in the source-area of ALHA 81005 is more noritic and troctolitic than the mafic component at Apollo 16, in agreement with earlier data [e.g. 6].

The impact glasses define a bimodal distribution of Mg/(Mg + Fe) ratios (Figure 2) that is reminiscent of the bimodality exhibited by pristine highlands rocks [e.g. 9,10]. As noted by Kallemeyn and Warren [5] and Laul et al. [7] where the bulk composition of ALHA 81005 was observed to plot between the two pristine highlands suites (i.e Mg-rich rocks; ferroan anorthosites), the impact glasses appear to define a mixing line connecting these two pristine components [2]. Figure 2 suggests that a compositional range of regoliths exists in the source area of ALHA 81005 indicative of mixing between pristine rock components. This view is compatible with global geochemical inferences derived from Apollo orbital data [e.g. 11-13].

A subset (~10%) of the impact glasses show that they formed from highlands regoliths having a detectable mare contamination. The presence of a small mare component has been previously suggested [e.g. 14-16]. The highest Ti glass yet reported in ALHA 81005 was observed as a 25-micron sphere in probe mount #8 and was analyzed in the present study (Table 1).

Table 1. High-Ti mare glass in ALHA 81005

SiO_2	45.3 wt.%	MnO	0.25
TiO_2	6.8	MgO	3.7
Al_2O_3	11.8	CaO	10.0
Cr_2O_3	0.12	Na_2O	0.44
FeO	21.4	K_2O	0.11

In agreement with earlier results [e.g. 2,14,15], no KREEP component was detectable in any of the glasses analyzed in this study.

CONCLUSIONS

The impact glasses in ALHA 81005 bolster earlier views regarding the petrological and chemical nature of the source area, as well as providing new insights. The following conclusions can be made:

(a) There is a bimodality of Mg/(Mg + Fe) ratios among regoliths of this region. This may be due to highlands provinces dominated by Mg-rich suite rocks in some areas, and by ferroan anorthositic suite rocks in other areas.

(b) The mafic component in this region is less gabbroic and more noritic and troctolitic than in the Apollo 16 highlands [e.g. 5,6,16].

(c) Mare contamination is chemically detectable in about 10% of the impact glasses analyzed in ALHA 81005 [e.g. 15]. A mare spherule with 6.8 weight % TiO_2 was observed (Table 1).

(d) The compositional range displayed among the impact glasses is a record of the compositional spectrum that exists among regoliths in the source-area of ALHA 81005.

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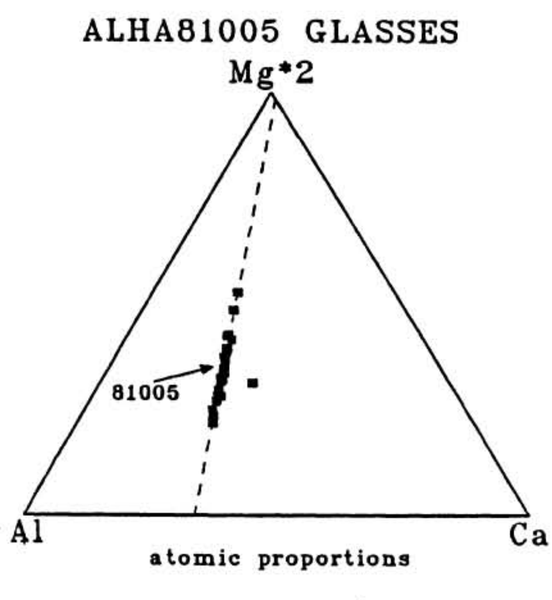

FIGURE 1

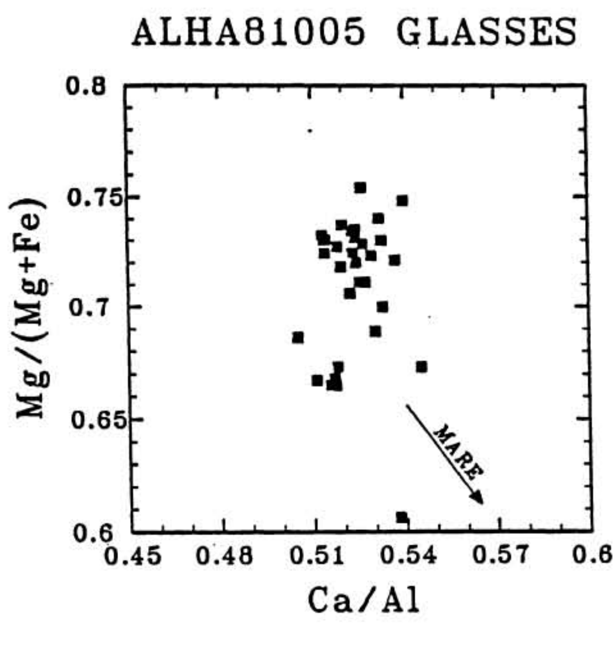

FIGURE 2