MAJOR-ELEMENT COMPOSITIONS OF GLASSES IN APOLLO 16 CORE 64001: CONSTRAINTS ON THE MARE COMPONENT. J. W. Delano; Department of Geological Sciences; State University of New York; Albany, NY 12222.

Introduction

A detailed geochemical investigation by Korotev [1,2] of the double drive tube core 64001/2 from station 4 on Stone Mountain showed that the depth-interval from 26 cm to 48 cm was enriched in exotic mare components relative to the depth-interval from 48 cm to 60 cm. In particular, concentrations of mare components were indicated to be present in three zones near 31, 42, and 47 cm depth [2]. Although each of these three intervals was thought to be composed of different combinations of mare components [2], all three zones could involve different types of high-Ti mare basalts. The main purpose of the present study was to place additional constraints on the nature of the mare components in the 64001 section through analysis of the glasses by electron microprobe.

Initial inspection of the 64001/2 suggested that the 42-cm depth-interval contained unusual rock fragments rich in opaque minerals, as well as subordinate orange glass [3]. Petrographic analysis later showed that the 42-cm depth-interval appeared to be enriched in mare-derived regolith breccias, in addition to minor fragments of mare basalts and mare-derived pyroxenes [4]. Previous studies of the exotic mare components at the Apollo 16 landing site have shown it to be diverse, in that it ranges from low-Ti to high-Ti compositions [e.g. 5-10].

New Data

Analyses have been made of 356 glasses from two depth-intervals (39.5 - 50.0 cm; 53.1 - 57.9 cm) in order to characterize the glass components within-and-below the mare-enriched portions of the 64001 core. The data have been plotted using combinations of non-volatile elements [11-13] in order to avoid the compositional scatter resulting from fractional vaporization of volatile elements (e.g. Si, Na, K) during impact melting [e.g. HASP; 10, 11, 13]. The non-volatile elements have also been combined in combinations that provide some information about the normative compositions of the glasses independent of fractional vaporization. For example, the atomic parameter (Ca-(Al/2)) shown in Figure 1 identifies the quantity of Ca not associated with anorthitic plagioclase (e.g. clinopyroxene). The atomic parameters in Figure 1 have been weighted by different coefficients (e.g. 5*Ti; 2*Al) in order to bring the data into the central part of the ternary, rather than having the data pile up in a small region of the figure where the different glasses could not be visually resolved. Since Figure 1 involves parameters with non-volatile elements only, fractional vaporization will not affect the locations of the individual data-points.

Figure 1 distinguishes between glasses with mare and highlands affinities [e.g. 10] using the CaO/Al_2O_3 weight-ratio (mare > 0.75; highlands < 0.75). In addition, the high-Ti, Apollo 11 mare regolith, 10084, is shown for reference in Figure 1, as well as the mare/highlands mixing line evident in Apollo 17 regoliths.

The glasses within both depth-intervals of the 64001 core are similar, and hence are plotted together on Figure 1. Within both depth-intervals, 23% of the glasses have mare affinities. Furthermore, within both depth-intervals, the general mixing trend among the glasses is toward moderate- to high-Ti mare components. This is in agreement with the conclusions made by Korotev [2] that the regolith geochemistry in the 64001 core was best explained by a high-Ti mare component. It is interesting to note that the mare component in the deeper portion of the core (53.1 - 57.9 cm) is apparently identical in character to that in the shallower, mare-enriched interval 39.5 - 50.0 cm). This suggests that the source (i.e. provenance) of the mare components in these zones of the 64001 core are the same. The cluster of high-Ti glasses from 64001 near the center of Figure 1 has been reported in other Apollo 16 regoliths [6, 7, 10]. The tendency toward a broad continuum among the glasses in

Figure 1 is interpreted as varying proportions of mare and highlands components in regionally diverse regoliths that were impact melted to generate these glasses [e.g. 6, 10, 11, 13, 14].

The provenance of the mare components in 64001 appears to be different from that indicated for other Apollo 16 regoliths. For example, the glasses from the station 4 surface-regolith, 64501, show that low- to moderate-Ti basalt components dominate [9], in contrast to the moderate- to high-Ti basalt components in the 64001 core. The low- to moderate-Ti basalt components also appear to dominate the glasses in core 60009/10 [9]. The mare-derived glasses in the Apollo 16 deep drill core [10] appear to contain both provenances.

Conclusions

(a) In agreement with Korotev [2], the glasses in core 64001 show that moderate- to high-Ti mare components are dominant.
(b) The provenance of the mare components above-and-below the 48-cm boundary in the 64001 core appears to be the same.
(c) The provenance of the 64001 mare components is different from that of the station 4 surface-regolith and the 60009/10 core near the LM site.

It is interesting, although perhaps only fortuitous, that spectral reflectance data [15] of the two maria (Tranquillitatis; Nectaris) nearest the Apollo 16 landing site may be consistent with the two mare provenances discussed in this abstract:

64001 (moderate- to high-Ti component): Mare Tranquillitatis
60009/10 (low- to moderate-Ti component): Mare Nectaris

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