THE APOLLO 17 DRILL CORE (SECTIONS 70009-70001): A TEST FOR INDIGENOUS VERSUS TRANSPORTED AGGLUTINATES; J.C. Laul\textsuperscript{1}, M.R. Smith\textsuperscript{1}, J.J. Papike\textsuperscript{2}, and S.B. Simon\textsuperscript{2}; \textsuperscript{1} Battelle, Pacific Northwest Laboratories, Richland, Washington 99352; \textsuperscript{2} Institute for the Study of Mineral Deposits, South Dakota School of Mines and Technology, Rapid City, South Dakota 57701-3995

It is now generally accepted that bulk agglutinates (glass plus clasts) closely approximate the composition of the soils in which they form (e.g. 1, 2, 3). However, the composition of the glassy portions of agglutinates still remains a controversial subject. Papike et al. (4) proposed a model whereby the glassy portions of agglutinates form by fusion of the finest fraction of the soil in which they originated. This model (F\textsuperscript{3}) predicts that the composition of agglutinate glass will fall on a mixing line between the composition of the <10 \( \mu \text{m} \) fraction and the bulk composition of the soil in which it formed. Whole agglutinates (glass plus clasts) will be close to bulk soil compositions, while pure agglutinate glass should approach the composition of the <10 \( \mu \text{m} \) fraction. Thus depending on the glass/clast ratio of the agglutinates the composition, according to the F\textsuperscript{3} model, should lie between that of the bulk and the finest fractions.

With the above background in mind, we have a method to test whether agglutinates in a particular soil horizon are formed in situ, i.e. are indigenous, or whether they were formed elsewhere and were transported to their present location. In previous studies of the Apollo 17 drill core, G.J. Taylor et al. (5) and Papike et al. (6) both found that the agglutinates do not have the bulk composition of the soils in which they now reside. G.J. Taylor et al. (5) explained this observation by assuming that the agglutinates were formed at a different location (fossil soils) and were then transported by impact to the A-17 drill core site. Papike et al. (6), however, believed that the agglutinates could have formed in situ and the compositional displacement from the bulk was biased toward the finest fraction.

In order to determine the origin of the agglutinates (indigenous versus transported; I- versus T-agglutinates) we carefully hand-picked agglutinate separates from the same 30 depth levels of the A-17 core for which we already reported chemical data for the bulk soils and for the 1000-90, 90-20, and <20 \( \mu \text{m} \) size fractions (7). The agglutinate separates were analyzed for 27 major, minor, and trace elements. Using the same four components that we used in our earlier studies (7), we performed mixing calculations on the agglutinate compositions (Figure 1).

Figure 1 displays the results of the mixing calculations for bulk soil compositions, grain size separates (1000-90, 90-20, <20 \( \mu \text{m} \)) and the agglutinate separates and provides a test for I- versus T-agglutinates. In brief, if the composition of an agglutinate falls outside of the soil composition range, this is evidence for a transported (T) origin; if it falls within the range it is "permissive" evidence for an indigenous origin (I). Using these ground rules the results are: I (0-22 cm), T (28-48), I (58-70), T (81-90), I (98), T (108-118), I (131-178), I (189), T (198-210), T (220-242), I (253), T (258-269), I (278-286). Agglutinates from units D and B clearly have fossil soil compositions. In section 70008 (Unit D, 22-48 cm) the agglutinates are enriched in mare components (81%) and contain 55% orange glass. These agglutinates could have originated near the orange glass-rich Shorty Crater soil site. Unit B is a very KREEPy unit that may be exotic to the Apollo 17 site (8). However, the agglutinates in Unit B are similar compositionally to agglutinates that lie above and below this unit. Based
on preliminary interpretation of these results, it is clear that the depositional history of the A-17 core is very complex (9). Some soil layers experienced relatively long near surface residence times at the A-17 drill core site permitting a large population of I-agglutinates to develop while others were buried relatively quickly and the agglutinate populations were largely formed elsewhere (fossil) and transported to their present location.