
Introduction. Bernatowicz et al. (1) observed excess xenon in Apollo 14 breccia 14301 which is organized into two functional components, volume-correlated and surface-correlated. The volume-correlated component is largely cosmogenic xenon, whereas the surface-correlated component is a combination of solar wind xenon and a result of extinct isotopic effects. To get a better understanding of the xenon components and the correlation of composition with grain size Laul and Lepel (2) conducted INAA analyses of grain size separates from this breccia. Bernatowicz et al. (1) disaggregated the breccia into 10 size fractions, and polished grain mounts of 9 size fractions (>25 μm) were allocated to us for petrologic studies. Our major objectives in this study are to rationalize the chemical and modal data for this breccia and to assess the nature of the fused soil component, FSC (agglutinate plus dark matrix breccia).

Results. The modes for nine grain size separates are presented in Table 1 and the data are shown diagramatically in Figure 1 for eight size fractions (the >595 μm PTS contained only four particles). The FSC is a maximum in the 595-500 μm fraction then drops off and peaks again in the 192-88 μm fraction and then falls off smoothly. Figure 2 shows the same data (with FSC removed) for the 7 size fractions that had a significant number of particles in the thin sections. The data show a continuous decrease in lithics with an increase in the mafic (olivine plus pyroxene) and plagioclase component. It is apparent that mafic is increasing (with decreasing grain size) at a greater rate than plagioclase and therefore the mafic/plagioclase ratio is increasing. This observation is shown more clearly on a lithics-mafic-plagioclase ternary data display (Figure 3) where the normalized modes trend toward the mafic apex with decreasing grain size. One would predict that with this trend of increasing mafic/plagioclase that the chemistry would reflect the modal change by an increase in MgO and FeO and a decrease in Al2O3 and CaO. Yet the data of Laul and Lepel (2) which are reproduced in Table 2 do not show this. The chemistry is virtually constant in the grain size range 500-25 μm. For comparison we calculated the fused soil free chemistry by a modal recombination technique (Vaniman et al. (3)) and these data do show the expected chemical changes with decreasing grain size, e.g., increase in MgO. How do we explain...
the disparity between the calculated and observed chemistry? The only logical answer appears to be in the nature of the FSC. Figure 4 shows a comparison of the observed chemistry with the calculated chemistry for the FSC free mode for the combined size fractions 500-25 μm. Differences between the two chemistries are assumed to be due to the chemistry of FSC which is not taken into account in the calculated chemistry. The enrichment and depletion patterns indicate that FSC is depleted in MgO, FeO, MnO and enriched in Al₂O₃, CaO, Na₂O and K₂O which is in accord with the predictions of Papike (4). In other words FSC is more feldspathic than the bulk soil. However, this cannot be the only factor explaining how the observed chemistry remains constant with an increased mafic/plagioclase ratio. There are two ways this can be accomplished: (1) an increased proportion of FSC in the mode with decreasing grain size or (2) FSC changes composition and becomes more feldspathic with decreasing grain size. Our data indicate that the second mechanism must be operative because the proportion of FSC in the mode decreases with decreasing grain size. These results are in agreement with the work of Woodcock and Pillinger (5) which indicates that agglutinates become increasingly
more feldspathic with decreasing grain size. This also could imply that in smaller grain sizes the glass/clast ratio in FSC increases and the agglutinate glass is enriched in feldspathic components (Papike (4)). The observed chemical data show an additional important feature; the chemistries are constant for the 7 size fractions between 500 and 25 μm but the < 25 μm fraction is quite different (Figure 5). It is enriched in feldspathic components relative to the coarser fractions (> 25 μm). This indicates that even though the mafic component increases with decreasing grain size in the size range 500 to 25 μm, below 25 μm there is a break in this trend with feldspar concentrating relative to mafic in the finest fraction.