COMPARATIVE PETROLOGY AND CHEMISTRY OF APOLLO 17 REGOLITH BRECCIAS AND SOILS; S.B. Simon[1], J.J. Papike[1], J.C. Laul[2], S.S. Hughes[3], and R.A. Schmitt[3], [1]Inst. for the Study of Mineral Deposits, S.D. School of Mines & Tech., Rapid City, SD 57701-3995; [2]Chemical Technology Dept., Battelle NW Laboratories, Richland, WA 99352; [3]Depts. of Chemistry and Geology and the Radiation Center, Oregon State Univ., Corvallis, OR 97331

As is the case for Apollo 15 samples, Apollo 17 regolith materials provide an opportunity to study highland-mare mixing at a lithologic contact. We have conducted a chemical-petrologic study of ten Apollo 17 regolith breccias to allow detailed comparison with the present-day regolith, to determine how many of the breccias formed locally, and to improve our understanding of the evolution of the Apollo 17 regolith.

Of the ten breccias studied, two (74115, from near station 3, and 76565, from station 6) formed from highland-dominated regoliths, and the remaining eight from basaltic regoliths. They are grouped accordingly and compared to Apollo 17 highland and mare soils, respectively, in Fig. 1. The breccias formed locally, and show the effects of highland-mare mixing. Basalt fragments are present in the highland breccias (HB) and highland rock fragments are present in the mare breccias (MB). Volcanic orange glass is present in all the samples, especially 70175, which appears to be a compacted orange/black glass deposit. The sample consists of abundant orange glass beads and fragments and olivine crystals with a minor amount of colorless glass and highland lithic fragments. This breccia is not included in the averages shown in Fig. 1. Jerde et al. [1] described a similar sample among their suite of A-17 regolith breccias.

Fig. 1 also shows that the soils have much higher fused soil (agglutinate + regolith breccia) contents than the breccias, a relationship observed in all the Apollo breccia-soil suites [2]. Removal of this component and renormalization (right pairs of columns) shows that the breccias have more devitrified glass (in the "Other" category) than the soils. This is mainly black, Ti-rich glass, and it has apparently been somewhat diluted in the soils by the addition of lithic fragments.

Abundances of several major elements in the breccias and soils are compared in Fig. 2. The plots of TiO_2 and FeO vs. Al_2O_3 clearly show the effects of highland-mare mixing, with wide ranges of compositions, unlike (for example) the uniform Apollo 14 suite [3]. The low-Al_2O_3 breccia is 70175; it has a composition very close to that of the orange volcanic glass. The two highland breccias are those with the highest Al_2O_3 contents. The breccias and soils plot along the same trend, indicating a local origin for the breccias. The plot of MgO vs. Al_2O_3 does not show a clear mixing trend because the highland "endmember" is a combination of anorthositic gabbro, noritic breccias, troctolite, and impact melts that are somewhat magnesian but have low FeO. This demonstrates the lack of a major anorthositic component in the Apollo 17 regolith [4].

Chondrite-normalized REE abundances in A-17 regolith breccias (except for 70175) and soils are summarized in Fig. 3. The breccias and soils overlap completely, mostly within the indicated range. The station 2 and "light mantle" materials are slightly enriched in the LREE, as indicated by the patterns for 72501 and 74115. This is strong evidence for local formation of the breccias.

The data also suggest ways in which the Apollo 17 regolith is changing. Several of the highland soils are more aluminous than the highland breccias, probably indicating accumulation of highland material at the bases of the

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massifs. On the other hand, the mare breccias from station 9 have lower TiO_2 and FeO contents than the soils from that station. The breccias may contain slightly more highland material than the soils because the large impacts required to deliver highland material to that station were more common prior to breccia formation than they are today. Presently, with continued exposure to micrometeorite impacts, the soil is being gardened, and the highland material mixed in and diluted.

References. [1] Jerde, E.A. et al. (1987) PLPSC 17th, E526-E536. [2] Simon, S.B. and Papike, J.J. (1989) GSA Bulletin, in review. [3] Simon, S.B. et al. (1989) PLPSC 19th, in press. [4] Warren, P.H. et al. (1987) PLPSC 17th, E303-E313.

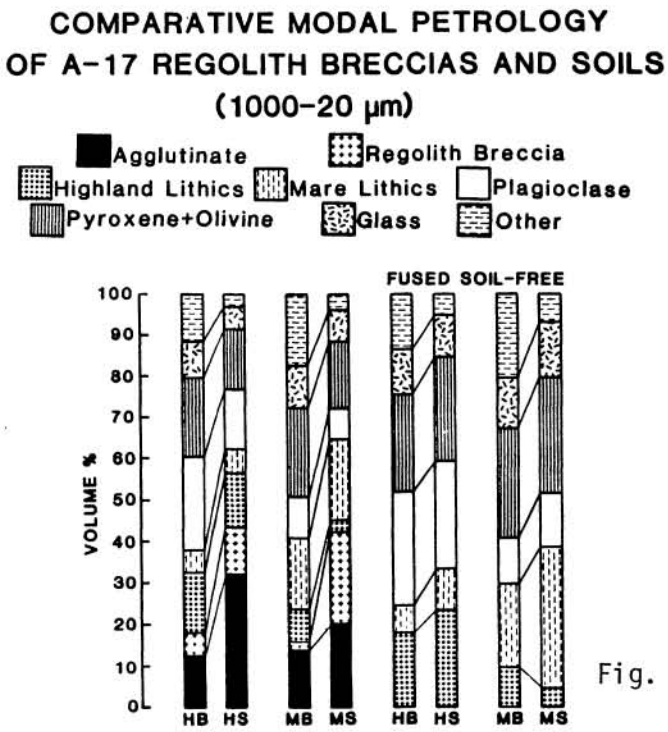

Fig. 1

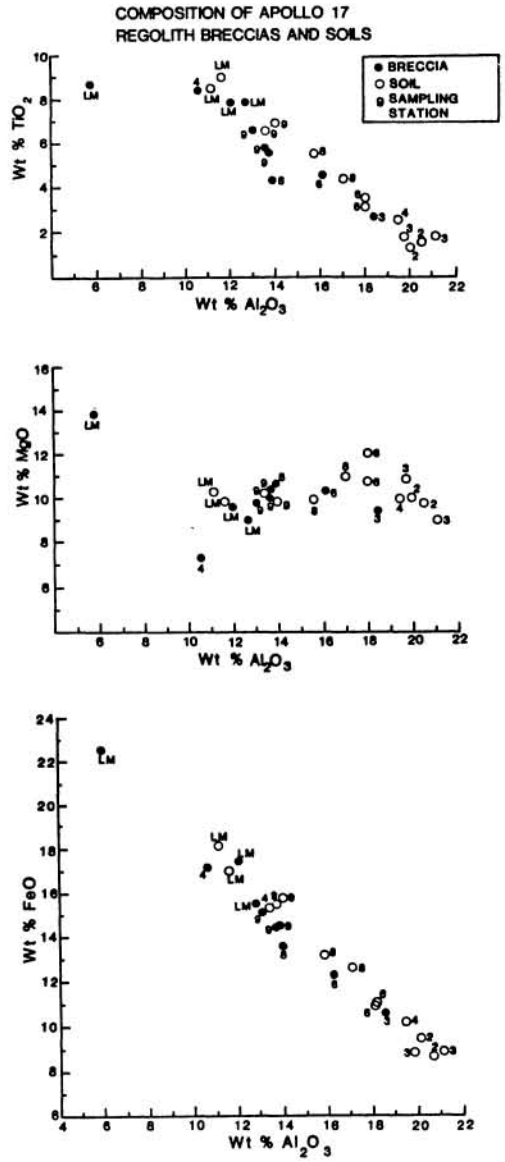

Fig. 2

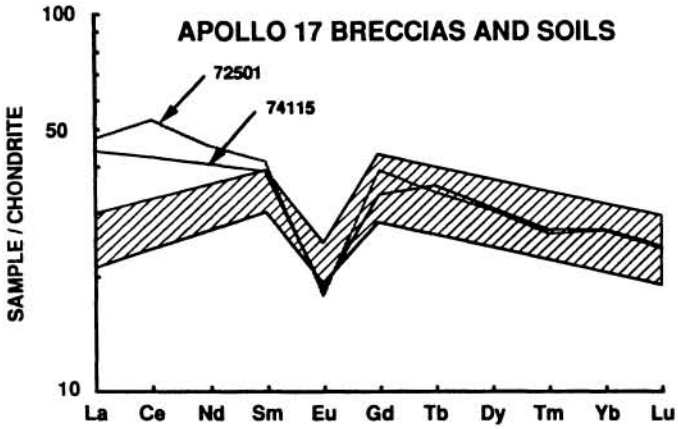

Fig. 3

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