SPECTRAL PROPERTIES OF AGGLUTINATE SEPARATES FROM SOIL 10084 C. M. Pieters, E. Fischer, J. Mustard, S. Pratt, (Brown Univ., Providence, RI 02912); A. Basu (Indiana University, Bloomington, IN 47405)

Introduction: It has been well known since the early spectroscopic measurements of Apollo samples that lunar soils have unique spectral properties. When compared to rock or lithic fragments, lunar soils are darker and exhibit a distinctive "red" continuum that becomes brighter with increasing wavelength from the visible through the near-infrared (1, 2). Diagnostic absorption bands due to various mafic minerals occur near 1 and 2 μm in both soils and rocks, but they are much weaker in soils. From analyses of the returned lunar samples, it was recognized that the peculiar optical properties of lunar soil are associated with the accumulation of alteration products in the soil produced with time in the harsh lunar environment (2, 3). Foremost among these soil products are agglutinates: complex glass-welded aggregates that make up much of a mature lunar soil (4). Although mafic glass (2), shocked plagioclase (5), and Fe metal (6) all have spectral properties which are to some extent similar to the special properties of bulk lunar soil, it has been assumed that accumulation of agglutinates is principally responsible for the optical alteration of lunar material. Presented here are the spectral properties of agglutinate separates prepared from Apollo 11 soil 10084.

Method: Particle size separates of bulk soil 10084 were prepared: 500 - 1000 μm, 250 - 500 μm and <250 μm. The large particles > 250 μm account for only ~14% of the bulk sample. Agglutinates were hand picked from the larger size fractions, creating agglutinate (A) and the remaining lithic-rich low-agglutinate (LA) fractions. A split of the <250 μm bulk soil (B) was dry sieved to < 45 μm and 45 - 250 μm. The <250 μm split contained roughly equal amounts of fine (<45 μm, 46%) and coarse (45 - 250 μm, 54%) particles. Bidirectional reflectance spectra were obtained for all samples using the RELAB facility at standard geometry (i = 30°, e = 0°) and are shown in Figure 1.

Discussion: Preliminary analyses indicate that although agglutinates are dark with weak absorption features, it is the finer fractions of lunar soil that are associated with the distinctive red lunar continuum.

Both the low agglutinate 250 - 500 μm and the bulk 45 - 250 μm soils are largely composed of rock and lithic fragments that are likely to be representative of the lithology of the Apollo 11 site. Spectra of these samples exhibit prominent mineral absorption bands that reflect the mixed basaltic lithologies. The same, but weaker, absorption bands exist in the spectrum of the <250 μm bulk soil superimposed on a red-sloped continuum.

As expected, the agglutinates are indeed quite dark with very weak absorption bands. Their absorbing character could easily account for the subdued nature of absorption bands in bulk soil. However, the continuum slope measured for these large agglutinates suggests that agglutinate formation alone cannot account for the distinct continuum slope (eg., <250 μm bulk soil). [This needs to be confirmed with smaller particle sizes.] This is supported by the fact that although the coarser particles (45-250 μm) of the <250 μm bulk soil separates make up about half the sample, it is clear that the fine particles (<45 μm) dominate the spectral properties, particularly the continuum, of the bulk sample.

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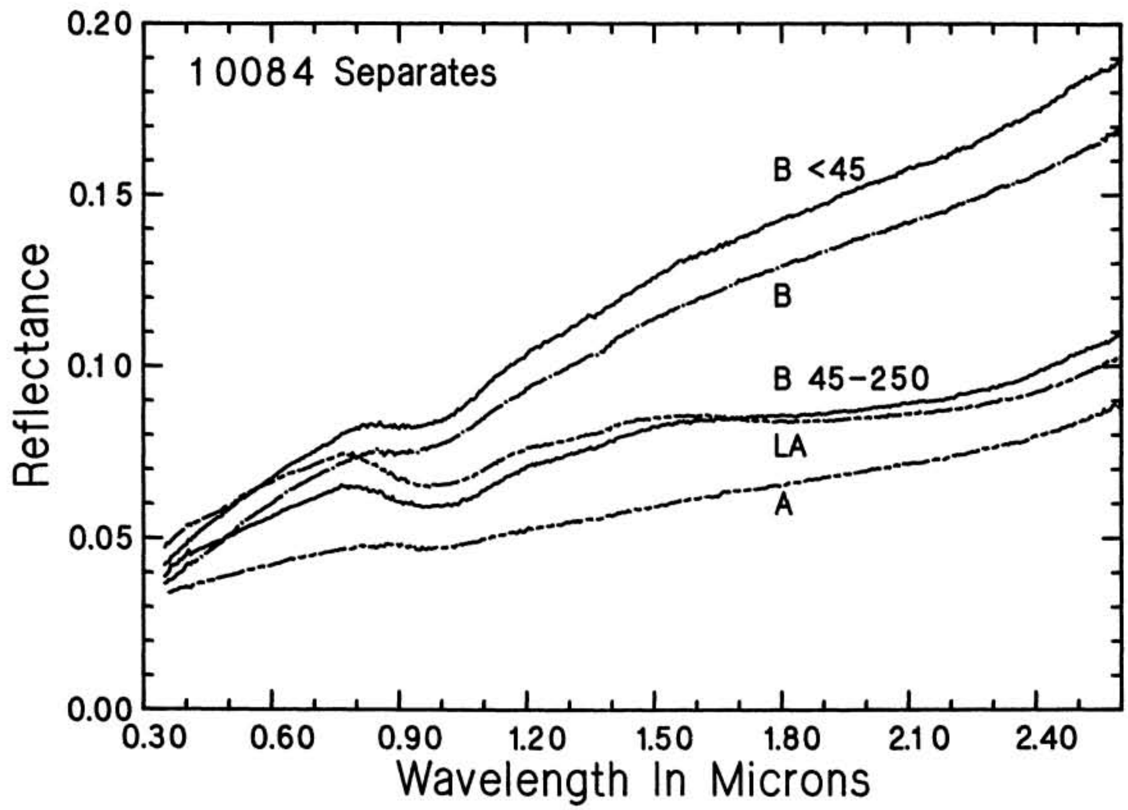

Figure 1. Bidirectional reflectance spectra of 10084 separates. B: bulk soil; B<45: less than 45 µm size separate of the bulk soil; B45-250: 45 to 250 µm size separate of the bulk soil; A: agglutinate separate; LA: low agglutinate separate (agglutinates removed).