resolution), relative to a halon standard and calibrated to the absolute reflectance of halon as determined by the National Institute of Standards and Technology. Biconical diffuse reflectance spectra of the same samples were also measured in a purged environment (water and CO_2 free) using the RELAB Nicolet 740 FTIR (Fourier-transform infrared) system from 2 to 25 μm (9 nm resolution). The FTIR spectra were scaled to the absolute values of the bidirectional data near 2500 nm. FTIR spectra of lunar mineral separates are provided in Figs. 1b and 1c for comparison to the BDR spectra of Fig. 1a. The RELAB IDs for all samples included in this study are provided in Appendix.

RESULTS

Suite 1: Apollo 17 Melt Breccia Samples

Original Crystalline Melts

The crystalline melt sheet spectra of Suite 1 have been divided into two groups based on properties inferred from their spectral features shown in Fig. 1d. The first group of spectra (Category 1A, shown as orange) has spectral characteristics of typical lunar highland rocks, variable mainly in the relative abundance of pyroxene and plagioclase. All but 73217 exhibit absorption bands due to low-Ca pyroxene. In contrast, 73217 has longer wavelength absorption bands, indicating a high-Ca pyroxene-rich composition and lower albedo, but is otherwise unremarkable. All spectra exhibit a weak absorption near 1.2 μm which may be attributed to plagioclase and/or rapidly cooled pyroxene.

Compared to Category 1A, the Category 1B spectra (blues and purple in Fig. 1d) have a lower albedo, a somewhat redder continuum (i.e., overall increase in reflectance with wavelength), and weaker absorption bands. The prominent difference between 1A and 1B may lie in the presence of an additional absorption near 600 nm for the Category 1B spectra. As discussed in detail in the Microcrystalline Ilmenite section, we interpret the 600 nm feature in these samples to indicate the presence of submicroscopic ilmenite interspersed in a transparent host.

Photomicrographs prepared by Graham Ryder of the Suite 1 samples are shown in Fig. 3. It is clear that Category 1B samples are finer grained than the 1A samples. The finer texture is also associated with the presence of a stronger 1.2 μm absorption band. The 1B samples also were observed to exhibit very fine, needle-like oxides. Among the 1B samples, the two with the lowest absolute reflectances and strongest 600 nm features (77075 and 72435) have the most fine-grained needle-like Ti-oxides.

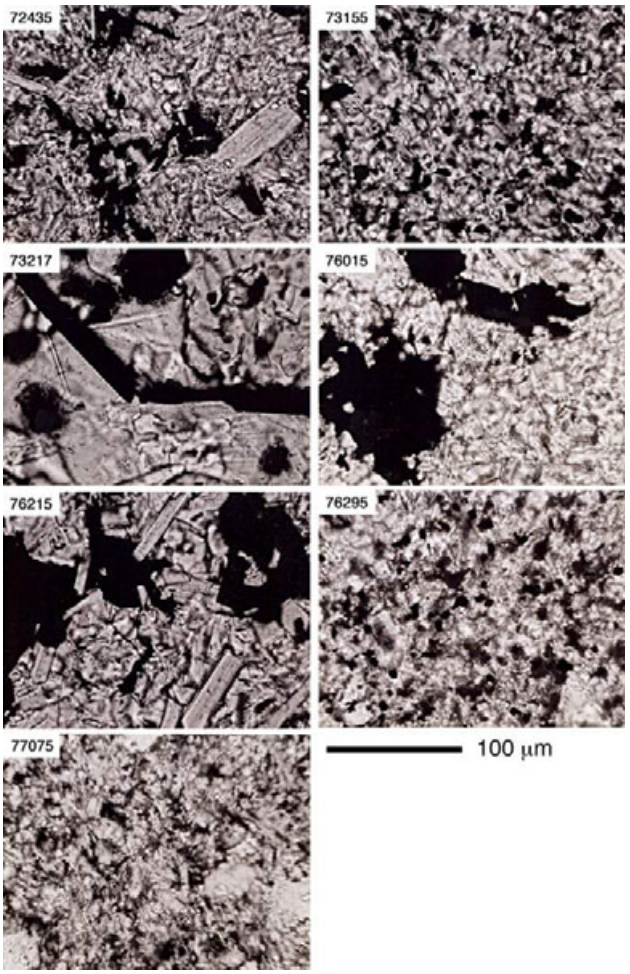

Fig. 3. Photomicrographs of Suite 1 samples. The scale bar is the same for all.

Quenched Glass Spectra

Bidirectional reflectance spectra of the Suite 1 quenched glasses prepared under lunar-like conditions from the crystalline melt breccias are shown in Fig. 1e. The color code for specific glasses is the same as used for their crystalline counterparts in Fig. 1d. Compared to the related crystalline suite of melt breccias, these quenched glass spectra exhibit considerably less variability. For example, while the crystalline version of 73217 is distinct from the other Suite 1 crystalline samples because of its atypical pyroxene composition, the 73217 glass is almost indistinguishable from the rest of the glasses. For all of the samples, the broad absorption bands centered just beyond 1 μm and near 1.9 μm are diagnostic of Fe-bearing glass (Bell et al. 1976; Burns 1993). The broad crystal-field 1 μm band combined with an oxygen-metal charge-transfer in the ultraviolet produces a prominent reflectance peaks near 0.56 μm that results in the visually bright green color of the glass powders.