The double drive tube 74001-74002 is ~67 cm long and was taken on the rim of Shorty Crater. The drive tube consists primarily of orange glass droplets and black, partially crystallized material (1). The orange and black phases are essentially identical to one another and to the orange glass in sample 74220, both in chemical composition and in grain size distribution (2). The orange and black glasses in 74001-74002 are a highly immature soil with a very low surface maturity index (3). This material is probably the best approximation of a simple, single component soil in the lunar sample collection and as such should provide the simplest case for studies of regolith dynamics and/or for attempts to 'date' a lunar soil. An accurate age determination of the orange and black glass would establish obvious constraints on theories of the origin of this unique material.

The chronology of the orange glass from 74220 has been studied by several workers. Tatsumoto et al. (4) calculated a U-Pb age of 3.63 Gyr, assuming a two stage evolution history for 74220. Hintenberger and Weber (5) reported a K/Ar age of 3.5±0.3 Gyr. Stepwise heating 40Ar-39Ar studies of the orange glass in 74220 have yielded ages (old constants) of 3.71±0.06 Gyr (6), 3.54±0.05 Gyr (7) and 3.60 to 3.71 Gyr (8). We have recently shown (9) that total fusion 40Ar-39Ar analyses of handpicked, grain-sized orange glass from 74220, and the sums of the stepwise heating data (6-8) are all compatible with an age of 3.66±0.03 Gyr (new constants). Eugster et al. (10) have reported a K/Ar age of 3.64±0.10 Gyr (new constants?) for 74001-121/2.

We have prepared six grain-sized separates from samples 74001,1076, 74001,1080, and 74001,1089. At the time this is being written, total fusion 40Ar-39Ar analyses have been completed for six grain-sized separates of 74001,1089 and for one separate, 74-250 μm, of 74001,1076. The results of these analyses are shown in Figs. 1 and 2. These data are preliminary in that they have not been corrected for fluence variations. Such variations are typically less than 1%, however. Fig. 1 is a plot of $^{38}Ar/^{36}Ar$ versus $^{37}Ar/^{36}Ar$. The linear array indicates that these isotopes can be explained as a mixture of one spallation component and one trapped component. These data contain a much higher spallation to trapped ratio than is found in a more mature soils. (The +250 μm fraction of 74001,1089 contains within errors no trapped argon.) The analogous data from 15531 (11), for example, would all plot to the left of the -4 μm datum in Fig. 1. In addition, the coarsest fractions in more mature soils typically yield data which plot well off the trends defined by the finer fractions. The slope of the line in Fig. 1 corresponds to a volume correlated spallogenic 36Ar content of (3.1±0.2) x 10^{-8}cm³/g and is in the range found by earlier analyses of 74001 (3,10,12).

Fig. 2 is a plot of $^{40}Ar/^{36}Ar$ versus $^{40}K/^{36}Ar$ for data from the <250 μm fraction of 74001,1089. Since all of the tr 36Ar in the +250 μm fraction can be accounted for by spallation, the datum representing the +250 μm fraction cannot be plotted on this diagram. The data define a linear array whose slope corresponds to an age of 3.65±0.020 Gyr. (The $^{40}Ar/^{39}Ar$ ratio in the +250 μm fraction corresponds to an age of 3.67±0.05 Gyr.) The 74-250 μm fraction of 74001,1076 also yields data which plots precisely on the line. The excellent agreement of these ages with those for 74220 outlined above strongly supports an age of ~3.66 Gyr as the formation age of the orange and black glasses in these soils. The intercept of the line in Fig. 1, 9±1, is in reasonable agreement with Eugster et al.'s (12) value of 6±3 for 74001.
The average of 8 Rb/Sr ages listed in (13) for Apollo 17 basalts is $3.68\pm0.08$ Gyr (new constants). The orange and black glasses therefore are, to a high precision, contemporaneous in time and space with the Apollo 17 basalts.

References:

Figure 1.
40Ar-39Ar STUDIES OF 74001

Saito and Alexander

Figure 2.