IRRADIATION STRATIGRAPHY IN DOUBLE DRIVE TUBE 60009/10. G. E. Blanford and J. A. Hawkins, University of Houston at Clear Lake City, Houston, Texas 77058

Track density measurements that we have made in impregnated soils of the lunar double drive tube 60009/10 clarify the depositional history of this core. We use three properties of the data to deduce depositional information about lunar cores. Track density frequency distributions indicate whether submature soils have undergone surface reworking (path 1 evolution) or were mixed prior or during deposition (path 2 evolution). Limited space prevents a display of these distributions for 60009/10. The fraction of high track density grains is a useful surface maturity index; we display these as the percentage of grains with track densities >10^3 cm^-2 (%>10^3) in Figure 1(b). The lowest track density (P_min) is related to the exposure age of a stratum provided that the grain had received no cosmic radiation prior to deposition and was not subject to in situ reworking. Preliminary values for P_min evaluated by us together with data from Crozaz and Dust (5) are shown in Figure 1(a). Maturity indices Ig/FeO (Fig. 1(c)) (7), agglutinate contents (Fig. 1(d)) (6) and surface correlated rare gases (Fig. 1(e)) (3, 4) are shown for comparison.

Experimental procedures for 60009/10 were essentially the same as those described by Blanford and Wood (2) for 60002 except that the total etching time for determining P_min was reduced from 18 h to 15 h. Depth assignments in 60009 allow for 0.5 cm of material that appears to be missing from our samples between the two core sections.

Description. Variations that we note in the core appear to correspond to boundaries based on color, texture and grain-size, therefore, we give our descriptions using the dissection units in the Lunar Core Catalog. The dissection units are grouped according to what we believe are distinct irradiation units.

60009. Units 1 and 2 (59.3 - 57.3 cm) consist of submature, path 2 soil. The more mature component of the mixture may be a submature, reworked soil. Units 3 and 4 (57.3 - 49.8 cm) have immature soil at the bottom progressing to mature soil at the top. Although one of the soils in unit 3 has a bimodal track density distribution, the general trend from lower to higher depths in unit 3 is consistent with path 1 reworking. The unit 4 soils are path 1 submature-mature soils. Units 5, 6 and 7 (49.8 - 39.3 cm) consist of immature-submature, path 2 soil in which the two components generally appear to be randomly mixed.

60010. Units 8, 9 and 10 of 60009 and units 1, 2 and 3 of 60010 (39.3 - 14.7 cm) consist of immature, submature and mature, path 2 soils. The soils generally show a progression from immature-submature path 2 soil in 60010 unit 3 to mature soil in 60009 unit 8. In other words, there is generally a greater admixture of a mature component with increasing depth. Unit 4 (14.7 - 11.3 cm) consists of mature soil. Units 5 and 6 (11.3 - 5.0 cm) consist of submature, path 1 soil. Unit 7 (5.0 - 0.0 cm) consists of mature and submature, path 1 soil.

Discussion. One view for the emplacement of the 60009/10 core has the materials deposited all at once or in very closely spaced intervals and requires that they remained in place for 125 My except for in situ reworking of the upper 12.5 cm (3, 4, 6, 7). Our data supports this view with a few additional refinements. Our search for fossil surfaces is not yet complete, but so far we only see conclusive evidence for one at a depth of ~50 cm at the unit 4-5 boundary. This is the same surface identified by Crozaz and Dust (5) at
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~52.5 cm, but we consider that the 2.5 cm difference represents the reworking zone. The model exposure age for this surface is 8-17 My. Although we see some partial evidence for fossil surfaces at ~23 cm and ~37 cm, the data are not consistent and for the present we conclude that they are not fossil surfaces and that the remaining 50 cm of the core were laid down in one event. It appears to us that this layer underwent in situ reworking to a depth ~14.5 cm (Fig. 1b). In addition we believe that the profile of % > 10^9 in 600010 units 5, 6 and 7 indicates two distinct turnover events which have occurred relatively recently. The earlier of the two was the single event turning the soil over to a depth of 14.5 cm and the most recent event which turned the soil over to a depth ~3.5 cm. The last event must be very young but we can not put a time estimate on either event. Our preliminary estimate of the exposure age of the whole 50 cm layer is between 45-250 My which is in agreement with the estimate of < 125 My (3).

REFERENCES.

Figure 1 (a) Minimum track density grains in 60009/10 from Crozaz and Dust (5) together with some preliminary data from this work. The upper two curves represent track production as a function of depth for 45 My and 250 My and the lower two curves for 8 My and 17 My. (b) The fraction of grains with track densities greater than 10^9 cm^-2 (% > 10^9) (c) Surface maturity index I_S/FeO from Morris and Gose (7). Dashed lines in (b) and (c) represent divisions between immature, submature and mature soils. (d) Agglutinate contents for the 90-150 µm fraction of 60009/10 soils from McKay et al. (6). (e) Surface correlated rare gas contents for the 90-150 µm fraction of 60009/10 soils from Bogard and Hirsch (3,4).