FERROMAGNETIC RESONANCE AND MAGNETIC STUDIES OF THE APOLLO 16 DEEP DRILL CORE: SURFACE EXPOSURE AND COMPOSITIONAL STRATIGRAPHY. Richard V. Morris, NASA Johnson Space Center, Houston, TX and Wulf A. Gose, Univ. of Texas Marine Science Inst., Geophysics Lab., Galveston, TX.

The Apollo 16 deep drill core (60001 through 60007) has been the subject of many detailed investigations (1-15). In this abstract we report the results of Ferromagnetic Resonance (FMR) and magnetic studies of 215 samples of soil from the Apollo 16 deep drill core; these samples contain soil from virtually every 0.5 cm interval of the core. Our data are depth profiles of soil maturity (I_s/FeO, <250 μm), total iron concentration (FeO), and metallic iron concentration. The parameter I_s/FeO (<250 μm) is a surface maturation index and is thus representative of the time a soil has spent on the lunar surface (16).

In Figure 1 are the depth profiles of FeO and I_s/FeO (<250 μm). The maturity classification of I_s/FeO was taken from (16). The data points represent average values of the respective parameters for the stratigraphic units as given by (17); the numbers beside the data points correspond to those stratigraphic units. The large units designated by A through D were assigned by (2) on the basis of petrographic examination of thin sections from every core section except 60005. The depth scale is the maximum depth below the lunar surface (17).

It is readily apparent in Figure 1 that the stratigraphic units determined by (2) correspond to the major units in our data. Unit A, the lower 3/4 of 60002, is characterized by immature to submature soils with an average FeO concentration of ~6.3 wt. %. Unit B, the upper 1/4 of 60002, 60003, and 60004, is characterized by submature to mature soils with an average FeO concentration of ~6.3 wt. %. Thus our data show a relatively constant value of FeO for Units A and B and a very sharp break in maturity. The A/B contact has been interpreted by (12) as a fossil surface, i.e., the top of Unit A was the lunar surface for a significant period of time. It seems more likely that the A/B contact represents a mixing zone between the immature to submature layer A and the submature to mature layer B.

Unit C, 60006 and the bottom 1/2 of 60007, is characterized by mature soils with the FeO concentration decreased from ~5.0 wt. % to ~3.5 wt. % with decreasing depth. Unit D, the top 1/2 of 60007 is characterized by mature soils with an average FeO concentration of ~6.0 wt. %. Thus, the C/D contact is a very sharp compositional contact. The soils from 60005 have been redistributed and mixed (17) and their in situ stratigraphic relationships are thus uncertain. In any event, the in situ soils in 60005 were on the average submature with an average FeO concentration of ~5.9 wt. %.

The profiles of I_s/FeO and FeO in Figure 1 can be compared to the corresponding profiles for the 60009/60010 drive tube (18), which was collected ~50 m away from the deep drill. There is no obvious continuity in stratigraphy between the two cores, which demonstrates the lateral heterogeneity of the regolith. This is probably a manifestation of the random nature of meteoritic impact and variations in the composition of bedrock at the Apollo 16 site.

Decreases in maturity from the lunar surface in the Apollo 15 deep drill core and in 60009/60010 have been attributed to in situ reworking (18-21). The C/D contact in the Apollo 16 deep drill core constrains in situ reworking of the present-day surface at the site of this core to less than ~12 cm. We feel
that gardening to depths greater than ~12 cm would have smeared out the C/D contact. However, the decrease in maturity from the C/D contact is suggestive of a fossil surface at the top of Unit C with a gardening depth on the order of 50 cm. We see no compelling evidence for any other fossil surfaces in the deep drill core. As mentioned above, we feel the A/B contact is a mixing zone between the two layers which were deposited in their present location by one event or a series of closely spaced events.

In summary, our data indicate a fossil surface at ~12 cm with in situ re-working of that surface extending to a depth of ~60 cm and a mixing contact at ~190 cm. This stratigraphy is essentially equivalent to one of the three slab models presented by (15) on the basis of neutron stratigraphy.