OPTICAL PROPERTIES OF THE APOLLO 15 DEEP CORE SAMPLES.

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The albedo of 17 powder samples from the Apollo 15 deep core tube was determined. The position of these samples ranged from 15 cm to 108 cm depth from the top of the core.

Figure 1 shows the albedo, normalized by comparison with MgO, as a function of depth in the core tube, at λ = 5500 A^{o} and at a phase angle of 7^{o}. Due to the minute quantities of core samples available, the reflectivity measurements were made with very small (4mm in diameter) sample surfaces. In order to increase accuracy, every measurement was repeated with 3 different sample orientations and the data points represent the arithmetic average of these measurements. The upper and lower limits are also shown.

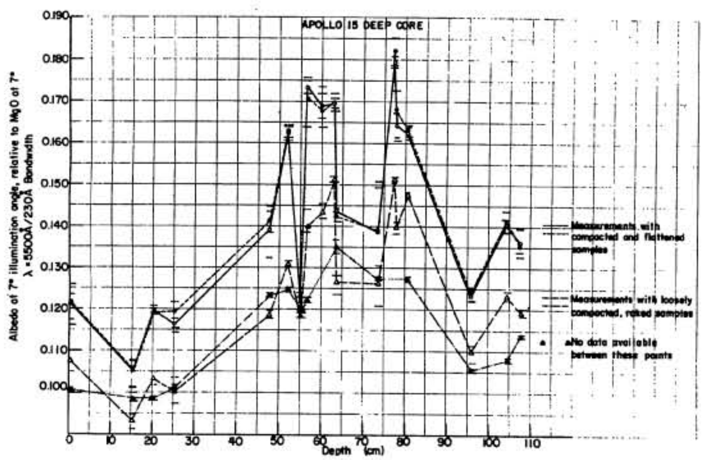

Figure 1

The different curves connect data points obtained with different sample preparation methods (as indicated in the figure). The albedo at 0 cm depth is that of a typical Apollo 15 surface sample, the top of the core sample not being available.

It is evident from Figure 1 that the variation of albedo with depth is significant. If we take the results obtained with the loosely compacted sample, (perhaps the closest to the actual lunar situation) we find the albedo varies between 9.3% (at 15 cm depth) and 15.2% (at 63 cm depth) and that this variation is a seemingly random function of depth. Bowell et al. (1) examined some 17 surface fines from the Apollo 11 to 15 sites and the Luna 16 and 20 sites and found that the albedo of these samples (at λ = 5850 A^{o} and at a phase angle of 5^{o}) varied between ~7.5% and 16.5%. Thus, just probing to 1 meter depth below the surface one encounters almost as significant a variation in the optical properties of the samples as the regional variations over the entire Moon.

It is also remarkable how sharply the albedo changes with a small change in depth. At 63 cm depth, for example, the albedo is 15%, whereas at 63.5 cm it is 12.7% This again, as we

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pointed out earlier (2), indicates the existance of a surface transportation mechanism which is capable of depositing a very thin layer of soil without mixing it with the underlying layer.

In Figure 2, we plotted the minimum cosmic ray track density counts (according to Fleischer and Hart (3)) in samples of one core tube section, along with our albedo results. These curves indicate a rather striking positive correlation between track density and albedo, suggesting that different layers had suffered a different history of surface exposure related to the darkening process. Comparisons of different regional samples had also suggested a relationship (Price et al. (4)) but of the opposite sign. This is not necessarily in conflict, since many situations can be envisioned where such a correlation, if it exists, can be of either sign. It is clear that a further study of this relationship would be most interesting both with surface and core samples.

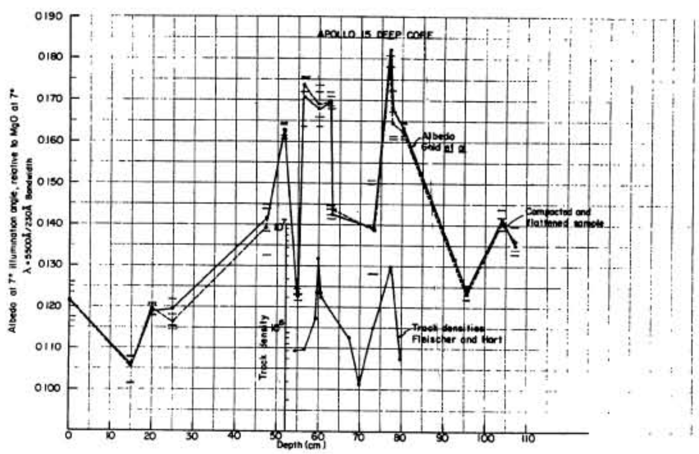

Figure 2

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2. Gold, T., Bilson, E., and Yerbury, M. (1973), Proc. 4th Lunar Science Conf., 3, 3093-3100.

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4. Price, B.P., Rajan, R.S., Hutcheon, I.D., Macdougall, D., and Shirk, E.K. (1973) in "Lunar Science IV," 600-602, The Lunar Science Institute, Houston.

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