THE ROLE OF HORIZONTAL TRANSPORT-AS EVALUATED FROM THE APOLLO 15 and 16 ORBITAL EXPERIMENTS, I Adler, M. Podwysocki, C. Andre, Univ. of Maryland, College Park, Md., J. Trombka, R. Schmadebeck, L. Yin, Goddard Space Flight Center, Greenbelt, Md.

Among the as yet not fully understood processes in the formation of the lunar surface are the roles of horizontal transport, vertical and lateral mixing, erosion, volatile transport etc. Further there are still arguments about whether the moon shows us a primary surface formed by accumulation processes or a secondary surface generated by magmatic processes modified by subsequent infalls(1).

It is our point of view that the orbital experiments flown on Apollo 15 and 16 provide us with a unique opportunity to examine, at least qualitatively, these transport mechanisms and to provide some evaluation of the extent of the transport mechanisms.

The various components of the orbital geochemistry experiments have shown us that there are distinct extensive regional variations. For example, the Xray experiment has demonstrated very marked differences between the highlands and the mare basins, the highlands being clearly richer in aluminum(inferentially more feldspathic)while the mare basins are low in aluminum(basaltic). On a large scale there is a good correlation between topography and aluminum content. The gamma ray experiment has shown unusual regional variations in radioactivity. Enhanced radioactivity has been observed in the Imbrium and Procellarum basins with peaks in activity occurring around Fra Mauro, Aristarchus and Archimedes.

In the areas away from the anomalous regions mentioned above there is an inverse correlation between radioactivity and the large scale topography(2).

The X-ray fluorescence experiment is particularly well suited to look at the problem of horizontal transport,in particular, the question whether the mare fill is highland material carried in by electrostatic forces. To appreciate this one must keep in mind that the X-ray measurements are extremely shallow. A 10 micron layer of basalt or feldspar would represent effectively infinite thickness. This is equivalent to about $3x10^{-4}$ g/cm^2 of material.

In a recently published paper "Conjectures about the Evolution of the Moon" (1) it was proposed that horizontal transport by such mechanisms as electrostatic charging have played a large role in the formation of the flat mare basins. It is obvious that if highland material had drifted into the basins to any extent we would not percieve the differences between the mare and the sourrounding highlands. In point of

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fact very marked differences have been found and will be demonstrated. There are outstanding examples such as the crater Tsiolkovsky. The ratio of aluminum in the rim area to that of the basin is about 2:1. Further we can show real differences in such relatively homogeneous sites as the Serenitatis-Tranquillitatis zones and in the Tranquillitis basin itself. There is additional substantiation in the recent paper of Kocharov and Victarov on the results obtained by the Lunakhod 2 in the crater Le Monnier (3). Using a portable X-ray spectrometer on the roving Lunakhod the investigators were able to make an acutal study of a transitional zone between Mare Serenitatis and the highland massif of the Taurus Mts. They found for example that as Lunakhod moved to the hilly region S.W. of Le Monnier, the iron content began to fall while the aluminum percentage rose. In comparison to measurements in the landing area, the Si/Fe ratio rose 1.5 times while the Al/Fe ratio rose by a factor of 2, suggesting rock analogous to terrestrial rocks of anorthositic gabbro or gabbroic anorthosite, apparently widely distributed in the highlands. Recent gamma ray results show that iron and titanium also show regional variations strongly suggestive of differentiation (4).

Finally we know that where soil in highland regions has been examined it is chemically like the highland rock in general. Similarly in mare regions the soil is generally like mare soil. Thus we can argue that it is unlikely that these chemical differences arise because one kind of rock is more easily broken up than another or more easily transported.

References: (1) T.Gold, The Moon, Vol. 7, Nos. 3/4, 1973. (2) J.I. Trombka et. al., Proc. of Fourth Lunar Science Conf., 1973 (3) G.E. Kocharov and S.V. Victorov, in press, Doklady, Akad. Nauk USSR (4) A. Metzger, Submitted to Fifth Lunar Science Conference.