

AN ANALYSIS OF THE APOLLO 15 X-RAY FLUORESCENCE EXPERIMENT FOR DETAILED LUNAR MORPHOLOGICAL AND GEOCHEMICAL PARAMETERS. Melvin H. Podwysocki, Jerry R. Weidner, Connie G. Andre, April L. Bickel, Rosalyn S. Lum, Dept. of Geology, Univ. of Md., College Park, Md. 20742; Isadore Adler, Jacob Trombka, Code 641, NASA - Goddard Space Flight Center, Greenbelt, Md. 20771.

X-ray fluorescence data gathered during the Apollo 15 flight while in lunar orbit were analyzed to determine the most efficient, consistent and sufficient summarization technique for the quantification of geochemical parameters. The goal of the task was to produce and test the resolution and reliability of Al/Si and Mg/Si intensity ratios in order to distinguish relatively small lunar features. Portions of Mares Tranquilitatis and Serenitatis were chosen as test areas because of a) the large areal extent of the available coverage, b) the density of the data points allowing comparison with the calculated ratios across several overlapping orbits in order to test the duplicability of the values and c) the desire to correlate outstanding physiographic features in what appears in a casual inspection as a homogeneous mare surface.

In order to determine the resolving capability of the system, 8 second data, the shortest time integration collected, was selected for the study area using a series of culling criteria. These included spacecraft elevation above the lunar surface, spacecraft attitude, and statistical reliability of the generated ratio data as determined by the calculated ratio errors and telemetry information. The resulting areal distributions of the Al/Si and Mg/Si ratios were then analyzed using trend surface analysis to determine the spatial relationships of the data. Both normalized and non-normalized data were used in this technique, the former being used so that additional statistical tests could be made on the result of the analysis. Analysis of variance was applied to the trend surface output to determine those surfaces with significant improvements in the information level of the model. A randomization process was also applied to the areally distributed data to test for spatial structuring. Additional trials were made with 16 second data using a sliding average (sliding window) to gain statistical reliability and the same modeling techniques were then used.

Results indicate that although the 8 second data are highly variable, Al/Si intensity values are not randomly distributed. Moreover, variations along orbit paths accounted for a significant amount of the information contained in the data. Examination of the trend surface analyses indicated that a second order surface, showing high Al/Si values in the highlands to the north and south of the mares and low values in the basins proper, provided the most suitable model for the test area. The residuals plot allowed delineation of adjacent orbits with like characteristics which could be correlated with some surface features. Application of the same techniques to the 16 second Al/Si ratios, with the addition of an additional culling criterion of the solar energy level, gave more reliable results with further demarcation of material types. Average values of Al/Si intensity ratios could then be calculated for those areas which behaved in a similar fashion.

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Using the results of the trend surface analysis, deviations from the regional model can be isolated. The craters Dawes, Bessel and the Jansen series can be distinguished by their higher Al/Si intensity ratios compared to their surrounding mares. Transitions between mares and highlands are relatively sharp. Areas of mare floor are distinguished where Al/Si ratios deviate considerably from the local mean.

Due to higher "noise" levels, Mg/Si ratios could not be treated in the same fashion. Additional work is being carried out to interpret this data.