COLOR CORRELATION OF X-RAY FLUORESCENCE Al/Si INTENSITIES WITH OTHER LUNAR DATA, P.E. Clark,2 E. Elison,3 C. Andre, and J. Adler at 1Chemistry Department, Univ. of Maryland, College Park, Md. and 2Astrogeologic Branch, U.S. Geological Survey, Flagstaff, Ariz.

This paper presents new color maps of the correlation of solar activity corrected X-ray fluorescence Al/Si intensity ratios(1) with (a) normal albedo (2), (b) laser altimetry data(3), (c) γ-ray data in the range 2.75-8.60 MeV which corresponds primarily to Fe, but secondarily to Ti, concentrations(4), (d) γ-ray data in the range 6.75-8.60 MeV which corresponds to Fe concentration(5). The technique for developing these color maps, and some of their geological implications are described.

The geochemical or geophysical meaning and original reduction method for normal albedo(2), laser altimetry(6), γ-ray data(7), and X-ray fluorescence data(8)(1) have been previously described. After reduction, each of the data sets was identically placed into a digital array, each element in the array (pixel) covering 1/4° latitude by 1/4° longitude.(9) Statistics were improved (with the loss of some spatial resolution) by applying an appropriate sliding average filter to the reduced data. (9) For each data set the following filter was applied (a) for Al/Si intensities a weighted average of 1 x 1, 3 x 3, 5 x 5, and 7 x 7 pixel filters(10), (b) for normal albedo no averaging filter(2) because the resolution was better than 1/4°, (c) for laser altimetry no averaging filter because the resolution was better than 1/4°, and (d) for the γ-ray data a 39 x 39 pixel filter(4)(5). Only data from areas where there was coverage from both data sets to be correlated were used in this study. Before correlation was done between data sets, the data set with superior resolution was refiltered to degrade its resolution to match that of the other data set. By this refiltering process, the resolution of both data sets used in the correlation is the same, and thus no artifacts due to differences in resolution are produced on the correlation map(11), but the resolution of the map will be that of the data set with the least resolution. The refiltering was done as follows for each of the four correlations: (a) a 5 x 5 pixel filter was applied to normal albedo for its correlation with Al/Si, (b) a 5 x 5 pixel filter was applied to laser altimetry data for its correlation with Al/Si, and (c) a 39 x 39 pixel filter was applied to Al/Si data for its correlation with the Fe data. A two dimensional array, consisting of Al/Si vs the other parameter, was produced and then divided into nine equal subarrays in a 3 x 3 matrix. Each subarray was assigned a specific color. In this manner, the color indicated the degree of correlation. Colors were assigned according to the following chart:

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These colors were chosen to logically represent the degree of correlation between two data sets. For example, a positive linear correlation would be indicated by a predominance on the map of shades of red, including pink, which indicates low values in both data sets, red, which indicates moderate values in both data sets, and maroon, which indicates high values in both data sets. In the case of a positive correlation, some shades of violet (lavendar or purple) appear in areas with either relatively lower Al/Si intensities or relatively higher values for the other parameter than predicted by a linear correlation. Shades of orange would be seen in areas with relatively higher Al/Si intensities or relatively lower values for the other parameter than predicted. An inverse linear correlation would be indicated by the predominance on the map of the three primary colors, blue for low Al/Si intensities and high values for the other data set, red for moderate in both, and yellow for high Al/Si intensities and low values for the other data set. In the case of an inverse correlation, lighter colors (light orange, lavendar) would indicate areas with relatively lower Al/Si intensities and/or values for the other data set than an inverse linear correlation would predict. Darker colors (dark orange, purple) would indicate areas with relatively higher values for one or both data sets than would be predicted.

In general, there is a good positive correlation with Al/Si for both visible albedo and laser altimetry. There are a few minor exceptions in the correlation of Al/Si with normal albedo involving (a) a high Al/Si, low albedo anomaly on a Nectarian basin unit(12) on the northeastern rim of Fecunditatis which may be caused by the highly agglutinated but highly aluminous nature of this area, and (b) a few small high albedo, low Al/Si anomalies on Copernican crater units(12) which may be caused by higher degrees of comminution in these areas. The minor exceptions to the correlation of Al/Si with laser altimetry involve (a) a few low elevation, high Al/Si anomalies in the highlands around Crisium, which are on units of Nectarian and/or Preneartarian age(12) and may be caused by the greatly eroded, yet highly aluminous nature of these areas, and (b) a high elevation, low Al/Si anomaly in the highlands west of Serenitatis which is on an Imbrian basin unit(12) and may be caused by a blanket of low Al material(such as feldspathic basalt) in this area. There is an overall inverse correlation of Al/Si with both Fe data sets, with the exception of an area centered on Palus Putredinis, Imbrian basin material(12), which is low in both Fe and Al/Si possibly due to the presence there of a feldspathic basalt, and of some areas southeast of Smythii, Preneartarian, Nectarian, and Imbrian crater units(12), which are high in both Fe and Al/Si possibly due to blankets of high Fe terra material in these areas.

Much of the finer detail present on the correlation maps of Al/Si with normal albedo and with laser altimetry is not present on the correlation maps with the Fe data sets. This is because filter size for the data used in the Fe maps is much larger, to represent the effective resolution of about 10°, whereas the filter used for the albedo and altimetry data is much smaller, representing an effective resolution of about 1°. If a feature on a particular correlation map is equal to or less than the size of the filter used on
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both data sets, it may be an artifact of correlation. Only features which are
1° or greater on any side in the case of albedo and altimetry correlation
maps, or 10° or greater on any side in the case of the Fe correlation maps,
were considered in this discussion. Each map gives semi-quantitative infor-
mation on the correlation of Al/Si with the other lunar data set; this infor-
mation is given in nine categories which are readily visually discernable.

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