HIGH SPATIAL RESOLUTION Mg/Al MAPS OF THE WESTERN CRISIUM AND SULPICIUS GALLUS REGIONS. Ernest Schonfeld, Geochemistry Branch, NASA Johnson Space Center, Houston, TX 77058.

Orbital geochemical experiments have determined the Al/Si and Mg/Si ratios of the surface of the moon by X-ray fluorescence (1,2,3). This chemical information has been important to interpret the surface processes and the evolutionary history of the lunar crust and mantle (4,5). It is the purpose of this work to present high spatial resolution Mg/Al ratio maps of two areas of the moon and discuss briefly the results. The technique used to obtain high spatial resolution maps is the laplacian subtraction method (6,7,8) which uses a special least-squares version of the laplacian to reduce noise (9). The data used is from the Adler et al. (1,2) X-ray fluorescence experiment modified by Bielefeld et al. (3).

The areas covered in this study include a highland region west of Mare Crisium, in which the high spatial resolution Mg/Al map presented in this study suggests volcanism, and the Sulpicius Gallus Region, which is one of the largest dark mantle regions of the moon.

West of Mare Crisium Region:

This region also corresponds to the NE Mare Tranquililitatis highland-mare interface. The original Mg/Al ratio map is shown in Figure 1. Darker regions correspond to higher Mg/Al ratios (i.e., Mare Tranquililitatis and possibly other small mare regions) and lighter regions correspond to lower Mg/Al ratios (i.e., highland type material). The area covered is a rectangle of about 8 x 9 degrees. Each picture element or pixel has a size of 0.25 x 0.25 degrees or about 7.5 x 7.5 km. The data array has a size of 34 x 36 pixels. The gray scale shown is linear (8). The minimum value in the gray scale corresponds to a Mg/Al ratio of 0.23 and the maximum corresponds to 0.58 or larger. The enhanced or higher spatial resolution Mg/Al map, prepared using the laplacian subtraction technique, is shown in Figure 2. The gray scale is the same as for Figure 1. When comparing Figure 2 with Figure 1, one can observe that in Figure 2 smaller features are resolved, the highland-mare interface is sharper, and in general the contrast is better.

In the highland region one can observe several relatively high Mg/Al small regions. Some of these regions are as follows:

1. One centered about 13.0 N, 46.6 E, with a local Mg/Al maximum of 0.61. This area corresponds to a geological unit of Its (10) which is a smooth terra material in a low lying terrain.
2. One centered about 12.4 N, 48.4 E, with a local Mg/Al maximum of 0.58. This area also corresponds to a geological unit of Its (10).
3. One centered about 11.5 N, 45.6 E, with a local Mg/Al maximum of 0.62. This area corresponds to geological units Its and Ip (10), where Ip is plains material.
4. One centered about 10.5 N, 46.1 E, with a local Mg/Al ratio maximum of 0.73, again corresponding to geological units Its and Ip.

To compare this local Mg/Al maxima with what might be the substrate of this region, the Mg/Al ratio of two craters was determined. One crater is Proclus (16.1 N, 47.0 E) with a Mg/Al ratio of 0.27; the other is Proclus P (15.3 N, 47.0 E) with a Mg/Al ratio of 0.26. The values of 0.26 to 0.27 are similar to the Apollo 16 and anorthositic gabbro Mg/Al ratios (11).

The previous local Mg/Al maxima (around 0.60) are significantly higher than the craters and are similar to the Mg/Al ratio of some mare soils (11). The fact that these local Mg/Al maxima have Mg/Al ratios similar to some mare soils and correspond to smooth geological areas (Its and Ip) (10), suggests that these rather small regions are small patches of mare material in the

© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System
lunar highlands. Not all the smooth geological units (Its or Ip) in this West Crisium region have high Mg/Al ratios. Therefore, some of these smooth geological units might have a volcanic origin and others a mass wasting (by cratering) origin (9).

Sulpicius Gallus Region:

This extensive region is one of the best known examples of dark mantled deposits (12,13,14). This region has high Mg/Al ratios consistent with the idea that the dark mantle material contains dark or orange glasses with very high Mg/Al ratios (11). The enhanced Mg/Al ratio map using the laplacian subtraction method is shown in Figure 3. The gray scale is included. The minimum value of the gray scale corresponds to a Mg/Al ratio of 0.34 and the maximum to 1.35 or larger. One can observe several high Mg/Al ratio regions. Some of these regions are as follows:

1. One centered about 19.25 N, 9.5 E, with a local Mg/Al maximum of 1.47. It is located in the dark mantle area of Sulpicius Gallus (14). The area is at the mare-highland interface at which an abrupt altitude difference (3 km) occurs within a distance of 5 km.
2. One centered about 18.25 N, 12.1 E, with a local Mg/Al maximum of 1.24. It is also located in the dark mantle area of Sulpicius Gallus at the mare-highland interface.
3. One centered about 21.7 N, 9.5 E, with a local Mg/Al maximum of 1.16. This region corresponds to the geological feature called Sulpicius Gallus Rima I and is also inside the dark mantle area.
4. One centered about 22.5 N, 7.25 E, with a local Mg/Al maximum of 0.88. This region is also inside the highland portion of the dark mantle area. For comparison, the low Mg/Al values in this general region of the highlands are about 0.39 to 0.42 and are similar to the values of the highland soils in the...
HIGH SPATIAL RESOLUTION Mg/Al MAPS OF THE WESTERN CRISIUM . . .

E. Schonfeld

SE Serenitatis Region (Apollo 17 site).

All these high Mg/Al regions are inside the dark mantle Sulpicius Gallus Region, but not all the dark mantle region of Sulpicius Gallus has high Mg/Al ratios (only about 60%). The Sulpicius Gallus Crater (centered about 19.6 N, 11.7 E) has a Mg/Al ratio about 0.51 and probably represents a mixture of some mare and non-mare material.

In summary, the Sulpicius Gallus area has several very high Mg/Al ratio small regions, suggesting high concentrations (about 40 to 65%) of orange, black, or similar high Mg/Al glasses (11). The highest Mg/Al ratios are at the highland-mare interface.


Figure 3. Mg/Al ratio of the Sulpicius Gallus region. This region has dark mantle material. Several high Mg/Al ratio areas suggest high concentrations of orange, black or similar high Mg/Al ratio glasses. Highest Mg/Al ratios are located at the highland-mare interface. There is no data in the blank areas. The Mg/Al ratio was enhanced by the laplacian subtraction method.