COMPUTER-GENERATED MAPS OF LUNAR COMPOSITION FROM GAMMA RAY DATA.
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The image processing computer system of the U. S. Geologic Survey in Flagstaff has been used to process counting data from the Apollo 15 and 16 gamma ray spectrometer experiments (1) in a new way to generate results in map format.

The basic system is described by Eliason and Soderblom (2). The input data were prepared by R. Radocinski at JPL. They consist of sums of corrected counts in specific energy bands, taken over 1^o squares on the lunar surface. These are the same input data used by Parker et al (3) for numerical analysis by the "West Coast method." So far three sets of these data have been processed: (a) the band from 0.55-2.75 MeV, whose count rate variations are mainly due to Th, U, and K (4, 5), (b) a narrower band, 2.53-2.675 MeV, centered on the prominent 2.61 MeV line of Th, and (c) a high energy band from 2.75 to 8.60 MeV. The variance in this high energy band is mainly due to Fe, but the contribution of Ti is not negligible. Events due to Si and O contribute strongly to the total count rate here, but the concentrations of these two elements do not vary significantly over the lunar surface (6).

The results, after various computer operations such as smoothing, and the elimination of areas of poor statistics, can be displayed in a number of ways. Color maps, substantially in the format of Frontispiece 1973 (4), are the most immediately useful. The older map for band (a) is substantially reproduced, but some features such as Mare Crisium and Mare Smythii show more clearly. This is in part due to an expanded data set (3) and in part to the new procedure reported here. Many interesting details, such as the spread of radioactive material beyond the edges of the western maria, are confirmed.

The narrow Th band (b) shows, as expected, a noisier signal. Both a direct comparison of the two color displays, and a correlation display in which intensity of one band is shown as red brightness, and that of the other as green brightness, show that except for noise in (b) the correlation is excellent. This parallels the results of Parker et al (3), and provides further confirmation that the broad band variation is due to the radioactive elements.

The most important of the new maps is that of the broad high energy band (c). We see here high values in the broad east and west maria, as expected. A map of Fe concentration earlier prepared by matrix inversion (7) and the results of Bielefeld et al (5) show the same thing. We also see definite high Fe concentrations in the regions of Mare Crisium and Mare Smythii, and low values near Archimedes, which have not been observed previously. The low-Fe highland material from 0-25^{o}E on the Apollo 16 track, and the gradual increases on either side of this region, are also significant. Other apparent features require further statistical tests. In any case this method of analysis gives a far clearer picture of regional detail in Fe than was available earlier.

There are other possible ways to study correlations between the bands. One is to display the ratio of two bands on a scale from black to white. In a map of Th/Fe, highland regions are dark because of the larger dynamic range of Fe composition. Eastern maria do not stand out from the highlands. However, there appears to be significant structure in certain highland regions which has not been noted before.

Unfortunately these color and black-and-white images cannot be reproduced in this volume. They will appear in the final publication.

References:

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(4) Frontispiece (1973), Proc. Lunar Sci. Conf. 4th.

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