ELEMENT CONCENTRATIONS FROM LUNAR ORBITAL GAMMA-RAY MEASUREMENTS;
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Maps of the radioactive content of the lunar regolith, in regions overflown by the Apollo 15 and 16 CSM, have already been presented (1, 2). In the present paper we give data on the elemental concentrations observed over a set of major mare and highland regions, as deduced from the natural and cosmic-ray-induced gamma ray spectra observed. The elements reported are (TH + U), K, Fe, Ti, Si, and O. Silicon and oxygen concentrations do not vary over the lunar surface beyond our limits of error; this is consistent with sample observations (3). The data on the radioactive elements confirm and extend the information obtained earlier by less complete analysis. No major region so far analyzed shows a Th content lower than about 0.5 ppm. The K/Th (and presumed K/U) ratio rises in the "coldest" regions of the lunar highlands. The Th level at the backside "warm region" near Van de Graaff approaches 4 ppm.

The variation of Fe over the surface follows broadly the expected pattern, with high Fe in mare regions falling to lower values in the highlands. The distribution of Ti seems to present some unexpected features. We expect later to present useful values for U and also for Mg, providing a cross-check with the x-ray data (4) and extending the area of coverage for this element. We are not optimistic about the elements Ca and Al.

The method of data reduction is basically that described in a recent paper (5). A background due to natural and induced radioactivity in the spacecraft, the diffuse "cosmic" gamma ray flux, cosmic-ray activation in the detector (6, 7), and the spectral continuum from the moon itself must be subtracted from the measured spectrum to obtain the discrete line spectrum. Part of this lunar continuum is itself dependent on the line flux, requiring iteration. In obtaining absolute concentrations from discrete line intensities of the natural radioactivities an absolute calibration is possible and the results are in good accord with ground truth (2). For the other elements the model is semi-quantitative, and the data are normalized to ground truth in areas well characterized by lunar samples and other studies (such as Mare Tranquillitatis).

There are interesting correlations with lunar topography and magnetic and gravitational features.

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