RADIONUCLIDE CONCENTRATIONS IN KREEP BASALT SAMPLES 15382 and 15386*

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KREEP is ubiquitous at the Apollo 15 sampling site and has been estimated (1,2) to be present at concentrations of more than 20% in some Apollo 15 soils and breccias. Basalt fragments with fresh subophitic textures and characteristic KREEP chemistry were discovered in soil 15023 by Meyer (3). Two very small samples, 15382 (2.2 g) and 15386 (6.4 g), were collected with the rake on the northeast rim of Spur crater, along the Apennine Front. Thin sections of these samples showed the textures and mineralogy expected for KREEP basalts, and major element compositions determined (4,5) on milligram-sized chips supported the classification of these samples as Apollo 15 KREEP basalts.

We have measured the radionuclide contents of these basaltic fragments by our technique of nondestructive gamma-ray spectrometry (1), which has very high sensitivity even for samples as small as 15382 and 15386. The principal objective of this study was to characterize accurately the whole-rock average concentrations of K, Th, and U, which are important constituents of KREEP. The results of this study are summarized in Table 1. For comparison we have included in Table 1 the primordial radioelement concentrations in 14271, a KREEP-rich breccia from Fra Mauro. We have also listed in Table 1 the composition of pure KREEP derived by use of the mixing model of Schonfeld and Meyer (2).

The respective concentrations of K, Th, and U in 15382 and 15386 are quite similar, and they, in turn, closely resemble the concentration pattern of KREEP. No other lunar rock type has K, Th, and U concentrations similar to KREEP. The correlations between K, Th, and U abundances of 15382 and 15386 and their Al2O3 content (~15% by weight) are compatible with relationships observed (6,7) for other samples of KREEP from Apollo 15. Although the U and Th concentrations of 15382 and 15386 are lower than those expected from the mixing model of Schonfeld and Meyer, the KREEP compositions at the various Apollo landing sites have been found to vary by as much as 30%. Thus, the primordial radioelement concentrations of 15382 and 15386 suggest strongly that these rocks are pure Apollo 15 KREEP basalts. The fresh, subophitic textures of these basalts support this view.

Because of the long time between collection of the samples and the gamma-ray measurements and because of the intense interferences from the high concentrations of primordial radionuclides, 26Al was the only cosmogenic radionuclide to be determined. Within the accuracy of the values reported in Table 1, the 26Al concentrations appear to be saturation values, consistent with rake samples which have lain on or near the lunar surface for the past few million years.

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RADIONUCLIDES IN KREEP BASALT SAMPLES

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Table 1. Radionuclide Concentrations

<table>
<thead>
<tr>
<th>Sample weight (g)</th>
<th>K (ppm)</th>
<th>U (ppm)</th>
<th>Th (ppm)</th>
<th>26Al (dpm/kg)</th>
<th>K/U</th>
<th>Th/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>15386</td>
<td>6.41</td>
<td>4970±200</td>
<td>3.30±0.15</td>
<td>11.8±0.3</td>
<td>94±9</td>
<td>1500</td>
</tr>
<tr>
<td>15382</td>
<td>2.24</td>
<td>4900±500</td>
<td>3.1±0.4</td>
<td>10.5±0.5</td>
<td>74±20</td>
<td>1610</td>
</tr>
<tr>
<td>14271</td>
<td>5250±250</td>
<td>4.5±0.3</td>
<td>15.6±0.2</td>
<td>--</td>
<td>1170</td>
<td>3.5</td>
</tr>
<tr>
<td>KREEP</td>
<td>--</td>
<td>5200</td>
<td>4.5</td>
<td>17.2</td>
<td>--</td>
<td>1160</td>
</tr>
</tbody>
</table>


bSchonfeld and Meyer, ref. (3).