

Isotopic Composition of Thorium and Uranium in Apollo 12 Samples

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Abstract

Preliminary analyses for determination of the isotopic composition of thorium have been made on 13 different samples available from Apollo 12. The preliminary examination is a comparison of the $\text{Th}^{232}/\text{Th}^{230}$ activity ratio, as measured by alpha spectrometry, to the $\text{Th}^{232}/\text{U}^{238}$ atom ratio determined by isotope dilution. Samples of high potassium rock (12013L and 12013D), breccia (12034), and fines (12033) have activity ratios very close to the expected ratios calculated from the $\text{Th}^{232}/\text{U}^{238}$ atom ratios. Contingency fines (12070) have an activity ratio that is slightly less than that expected; however, all of the samples classified as crystalline rocks (12052, 12064, 12035, 12022, 12038, 12009, 12021, and 12063) have measured $\text{Th}^{232}/\text{Th}^{230}$ activity ratios that are 15 to 70 percent lower than those expected from the $\text{Th}^{232}/\text{U}^{238}$ concentration ratios. The variations from the expected ratios increase in the order listed above for the crystalline rock samples.

The reasons for these variations are not known; however, a search for the existence of an isomer of Th^{232} which undergoes radioactive decay by a process other than emission of a 4.0 Mev alpha particle is in progress. High resolution alpha spectrometry is being used to measure the fine structure in the alpha-particle spectra of thorium and uranium isotopes of selected lunar samples compared to terrestrial reference samples to determine if additional clues can be found for the existence of an isomer of Th^{232} .