The variation of the $^{236}$U and $^{239}$Pu concentrations as a function of depth has been studied in an undisturbed forest area in the Herbert River catchment (northeastern Queensland, Australia) well removed from nuclear weapon test sites. The chemical separation of U and Pu was carried out with a double column, which has the advantage of the extraction of both elements from a relatively large soil sample (~20 g) within a day.

The samples were measured by Accelerator Mass Spectrometry using the 14UD pelletron accelerator at the Australian National University. The highest atom concentrations of both $^{236}$U and $^{239}$Pu were found at a depth of 2-3 cm. The $^{236}$U/$^{239}$Pu isotopic ratio in fallout at this site, as deduced from the ratio of the $^{236}$U and $^{239}$Pu inventories, is $0.085 \pm 0.003$ which is clearly lower than the Northern Hemisphere value of ~0.2. The $^{236}$U inventory of $(8.4 \pm 0.3) \times 10^{11}$ at/m$^2$ was more than an order of magnitude lower than values reported for the Northern Hemisphere. The $^{239}$Pu activity concentrations are in excellent agreement with a previous study and the $^{239,240}$Pu inventory was $(13.85 \pm 0.29)$ Bq/m$^2$. The weighted mean $^{240}$Pu/$^{239}$Pu isotopic ratio of $0.142 \pm 0.005$ is slightly lower than the value for global fallout, but our results are consistent with the average ratio of $0.173 \pm 0.027$ for the southern equatorial region (0-30°S).