

## Mechanisms of $^{234}\text{U}$ enrichment in waters of carbonate terrains - Dead Sea watershed

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### Abstract

The isotopic activity ratio  $^{234}\text{U}/^{238}\text{U}$  in groundwater and runoff is controlled by various processes such as water-rock interaction, dissolution-precipitation mechanisms,  $\alpha$ -recoil processes, and mixing of various water types. In this study, we attempt to describe and formulate the processes dictating the  $^{234}\text{U}/^{238}\text{U}$  activity ratios in the waters from carbonate terrains from the Dead Sea watershed. We constructed a 1-D advection-reaction model for  $^{234}\text{U}$  and  $^{238}\text{U}$  assuming that the retardation factor of uranium is controlled by co-precipitation of uranium-carbonate complexes with calcite during recrystallization with the carbonate aquifer. This model was run for  $^{234}\text{U}$  and  $^{238}\text{U}$  (and the major ions composition) measured in waters sampled in various sources from carbonate terrain in the Dead Sea watershed. The waters were samples over a rather large areal extent from the freshwater Dan Spring in northern Israel that discharges Mt. Hermon Jurassic aquifers, the large groundwater reservoir in the south Levant, and the Sataf Spring that discharges the Judea Mt. Cretaceous aquifer and the Ein Gedi saline springs on the shores of the Dead Sea in southern Israel.

The model results suggest that  $^{234}\text{U}$  enrichment in the waters of these carbonate aquifers is controlled by direct  $\alpha$ -recoil mechanism and by the co-precipitation of  $^{238}\text{U}$ ,  $^{234}\text{U}$  during the recrystallization of the aquifer country rocks.