Plutonium-244 in the Early Earth

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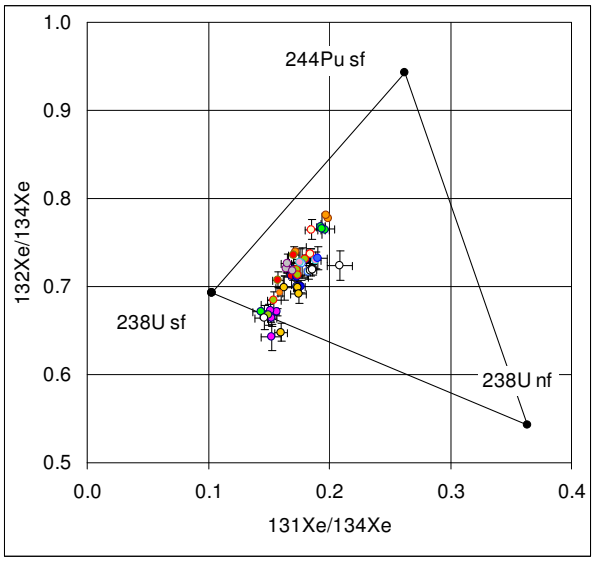
The presence of xenon isotopes from the in-situ decay of short-lived ^{244}Pu in ancient Jack Hills zircons provides a new time-sensitive window into the first few hundred million years of Earth history [1]. We are currently attempting to develop an understanding of three factors; the extent of post-crystallization fissiogenic xenon loss, its timing, and the geochemical behaviour of plutonium in early magmatism. We have investigated xenon loss by irradiating a suite of 17 zircons with thermal neutrons to generate Xe from ^{235}U neutron fission. ^{131}Xe/^{134}Xe and ^{132}Xe/^{134}Xe ratios can be used calculate the relative contributions from spontaneous fission of ^{244}Pu and ^{238}U and neutron fission of ^{235}U (see figure) and hence compare nominal Pu/U ratios and xenon retention ages. Measured Pu/U ratios (back calculated to 4.56Ga on the basis of Pb-Pb ages) range from zero to 0.012. U-Xe ages indicate that xenon loss is common and occurred typically between 3 and 4 Gyr ago. We are currently attempting to investigate the additional effects of geochemical fractionation of Pu from a comparison of Xe isotopes with REE/ U abundance ratios.



[1] Turner G., Harrison T.M., Mojzsis S., Holland G. and Gilmour J. (2004) *Science* **306**, 89-91.