

Sequential leaching experiments for understanding U behaviour under acid mine drainage conditions

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As evidenced in previous works (Barbero *et al.*, 2013), the ochre precipitates resulting from acid mine drainage processes play a key role for explaining the high $^{234}\text{U}/^{238}\text{U}$ ratios found in the resulting acidic waters. A series of leaching experiments have been performed in a río Tinto bedrock ochre sediment after separating five different size fractions. U concentration and $^{234}\text{U}/^{238}\text{U}$ ratios in the original sample were determined after total dissolution using HF and HNO_3 mixture. Results indicate that, for this particular sample, U is more abundant in the <125 microns fraction (5-6 ng/L) compared to the coarse fraction (around 3ng/L). $^{234}\text{U}/^{238}\text{U}$ ratios are very close to 1 in all size fractions, indicating a high detrital component (country rocks are Devonian rhyolites) which is also evidenced by the high proportion of quartz. Each size fraction was initially leached with 0.1M sulfuric acid. In the resulting leachates U concentrations are in the range of 0.23 to 0.44 ng/L and $^{234}\text{U}/^{238}\text{U}$ ratios between 5.6 and 6.8, showing no variation between different grain size in the original material. Residues after 0.1M sulfuric leaching were partially dissolved using a mixture of $\text{HClO}_4+\text{HNO}_3$ and aqua regia in one case, and HF and HNO_3 mixture for total dissolution in a second case. U concentration after partial dissolution of the residues are always < 2ng/L, the lowest values occurring in the residues with grains sizes <125 microns. $^{234}\text{U}/^{238}\text{U}$ in this case is the range 4.6 to 5.1. In the case of total dissolution of the residue, the resulting U concentration and $^{234}\text{U}/^{238}\text{U}$ ratios are both very close to the values in the original material. These experimental results show that $^{234}\text{U}/^{238}\text{U}$ ratio in the leachates is not affected by the extent of dissolution, neither by the grain size of the initial material.

[1] Barbero, L., Ketterer, M., Baskaran, M., Hierro, A., Bolívar, J. P. & Casas-Ruiz, M. (2013): U behaviour under acid mine drainage conditions: preliminary results form an experimental approach in Río Tinto area (Spain). *Mineralogical Magazine*, v. 77, pp 655.