Nd isotopes track rare earth element sources in acid mine drainage, Appalachian Basin, USA.

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Acid mine drainage (AMD) has been proposed as a potential source of strategic rare earth elements (REE). To simulate AMD-rock interactions, we conducted experiments using samples encompassing overburden, coal and underclay from an AMD site (Appalachian Basin Pittsburgh Coal). Sulfuric acid (0.05N) leached <10% of whole rock total REE from all samples except the underclay, which released 35%. Unlike the relatively flat NASC-normalized whole rock REE patterns, sulfuric leachates of these units (Fig. 1) show MREE enrichment similar to what is observed in AMD [1, 2].

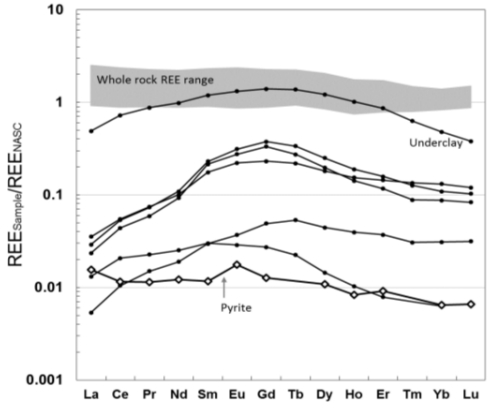

Figure 1: REE patterns of H_2SO_4 leachates (filled circles)

Measured $\varepsilon_{Nd(o)}$ values for the whole rocks range from -11.2 to -12.0, while most leachates fall between -6.2 and -9.3, similar to AMD from the Pittsburgh Coal. When corrected to the Carboniferous depositional age, the $\varepsilon_{Nd(T)}$ range narrows to -9.2 to -6.9 for all samples. These data, together with preliminary geochemical and petrographic analysis, suggest that the MREE enrichment of AMD could result from preferential leaching/dissolution of a high Sm/Nd mineral phase such as apatite.

[1] Cravotta (2008) *Applied Geochem.* **23**, 166-202
[2] Stewart et al. (2017) *Int. J. Coal Geol.* **169**, 28-39