Basaluminite as scavenger of contaminants in acid mine drainage: Structural and geochemical characterization

S. CARRERO[1*], R. PÉREZ-LÓPEZ[1], A. FERNANDEZ-MARTINEZ[23] AND J. M. NIETO[1]

[1]Department of Geology, University of Huelva, Campus 'El Carmen', 21071, Huelva, Spain (*Correspondence: sergio.carrero@dgeo.uhu.es)
[2]CNRS, ISTerre, F-38041 Grenoble, France
[3]Université Grenoble Alpes, ISTerre, F-38041 Grenoble, France

Acid Mine Drainage (AMD) presents low pH values and high concentrations of sulfate, iron, aluminum and other metal(loid)s [1]. While much has been reported on the important role of Fe-bearing phases as scavengers of contaminants in AMD, less is known about the role of Al-SO_4-phases. In the current study, lab-experiments and structural characterization have been performed to determine the retention capacity of toxic elements by basaluminite.

Results from alkaline titration experiments under anoxic conditions show two Al- and Fe(II)-buffers associated with the precipitation of first basaluminite and then green rust. These phases exert a significant mineralogical control on element mobility; in particular, unexpectedly, basaluminite presents a high capacity of As sorption. On the other hand, sorption-isotherm experiments of As into basaluminite show a ion exchange process between As and SO_4, where the 50% of SO_4 present in basaluminite can be exchanged by As with an exchange-ratio As/S of 2. Finally, basaluminite has been defined as nano-felsobanyaite [2], the basaluminite structure has been characterized with reverse Monte Carlo and pair distribution function to determine the bonding mechanics and retention capacity of the sorbed elements.

Basaluminite presents a high affinity for As, role hitherto masked by previous precipitation of ferric phases in natural conditions. These results provide a new view on several mineral precipitation pathways that could be controlling toxic element mobility in anoxic environments and acid sulfate soils, opening a new research line focusing on the optimization of treatment systems for acid mine waters.

[1] Nyquist and Greger (2009) *Ecol. Eng.* **35**, 630–642. [2] Farkas and Fertlik (1997) *Acta Mine. Petro* **38**, 5-15