Winogradsky-type columns as an insight into mineral neoformation and metal mobility in acidic pit lakes

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Abundant mineral neoformation is typically observed in Acidic Pit Lakes (APL) water column and bottom sediments. A wide pH range (1.9-4.5), high ionic strength, high metallic contents (e.g. Al, Fe, Mg, Mn, Cu, Zn, Ni, Cd, As, U), strong statification (meromixis) and sharp vertical gradients allow to investigate the dynamics of a variety of oxic and anoxic, highly acidic systems. Research methods include on-site boat-based physico-chemical profiling followed by water sampling at different depths, further filtration to separate pelagic mineral particles and water for chemical analysis [1], in-lake deployment of sediment traps and mineral precipitation traps [2], chemical laboratory assays and geochemical modelling. These tecnhiques have limitations, mainly because microorganism-metal-mineral interactions are usually very slow in nature, thus obscuring neoformed phases among detritial ones, and also because of the high depths (more than 40-100 m) at which these interactions take place.

Recently, the use of Winogradsky-type incubation columns has proven to be highly useful model systems to investigate geomicrobial interactions [3]. Filling it with acidic mine water and sediment from a selected depth allows to simulate in-lake conditions and user-friendly monitorization of geochemical parameters (e.g. pH evolution, ORP, nutrients) and mineral neoformation and diagenesis. New mineral phases include Fe-Al (oxy)hydroxysulfates, Fe oxyhydroxides and less studied Fe-Cu-Zn sulfides. The addition of glycerol to selected columns provoked the exponential growth of sulfate-reducing microorganisms and firm raise of pH inducing a much higher rate of sulfide formation. The evolution in untreated and cooled-stored (4 ºC) columns was rather limited. In this on-going experiment we expect to investigate mineral cristallinity and metal mobility during early diagenetic processes and microbial community evolution with possible environmental implications.

[1] Sánchez-España *et al.* (2020) *MINE WATER ENVIRON*, 1-21. [2] Yusta *et al.* (2011) *Macla* ***15***, 201-202. [3] Diez-Ercilla *et al.* (2019) *J SOIL SEDIMENT* ***19***, 1527-1542.