Phosphorus sequestration by magnetotactic bacteria in the water column of Lake Pavin: insight into the biological and environmental controls

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Microorganisms have been shown to be major actors in modern and past geochemical cycles of phosphorus (P) [1, 2]. Their role in phosphatogenesis, *i.e.* the formation of P minerals within sediments, is well recognized [3, 4]. However, only few models of microorganisms highly sequestering P are known, most of which have been identified at water-sediment interfaces in marine environments. Identifying new models of P-hyperaccumulators in freshwater environments is therefore an important issue.

Recently, we identified freshwater magnetotactic bacteria (MTB) affiliated to the *Magnetococcaceae* family, which, similarly to the marine *Thiomargarita* and *Beggiatoa*, are sulfoxidizers and accumulate intracellular PolyP to a uniquely high extent [5]. We detected them in the oxic-anoxic transition zone (OATZ) within the water column of the ferruginous Lake Pavin (Massif Central). MTB can be easily recovered by magnetic sorting and thus represent interesting targets for bioremediation.

Here, we combine scanning and transmission electron microscopies, confocal laser scanning microscopy and flow cytometry to assess the distribution of MTB subpopulations and the relative abundance of PolyP-bearing cells above, within and beneath the OATZ of Lake Pavin water column. Bulk quantification of P species is applied in concert with submicrometer-scale spectroscopy techniques. We evidence a stratified succession of different MTB morphotypes in relation with specific physicochemical conditions.

[1] Cosmidis et al. 2013 & 2015. *Chem. Geol.* **359**, 10-22 & *Front. Earth Sci* **3**, 84. [2] Diaz et al. 2008. *Science* **320**, 652–655. [3] Bailey et al. (2013) *Geobiology* **11**, 397-405. [4] Schulz & Schulz 2005. *Science* **307**(5708), 416–18 [5] Rivas-Lamelo et al. (2017) *Geochem. Persp. Let.* **5**, 35–41.