Biogenic iron oxides: What's next?

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The last decade of research has provided very valuable information with respect to the isolation, growth and metabolic pathways of new microorganisms capable of oxidizing ferrous iron responsible for the formation of biogenic iron oxides (BIOS). In this presentation, we report on the latest research on the redox stability of various BIOS samples rich in metals and metalloids. We also question the use of gamma radiation to sterilize natural BIOS samples. Our results first indicate that BIOS are efficient at sequestering soluble contaminants, but upon microbial reduction, they release some of their sorbed contaminants into solution. Microbial reduction rates of fresh BIOS have been shown to exceed those measured for synthetic Fe-oxides having similar mineralogy, but upon ageing, coarsening of the iron oxide particles in BIOS occurs, thus lowering the reduction rates. BIOS are currently understood to be stabilized by the presence of organic templates, such as exopolysaccaharides (EPS). This would lead one to expect that BIOS are more stable than abiotic iron oxides subjected to microbial reduction. Our results indicate that this may be the case if gamma radiation is not used to sterilize BIOS. Sterilization appears to cause structural damage to biogenic iron oxides as a result of the formation of radicals during the radiation of organic matter. Radicals are thought to play a role in the reduction of structural Fe(III) to Fe(II) prior to microbial reduction. We present new results demontrating the effect of gamma radiation on gamma-irradiated and non-gamma-irradiated synthetic BIOS, and abiotic iron oxides having substantially equivallent mineralogy.