Bioprecipitation of phosphates and sulfates in experiments with Streptomyces acidiscabies

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Some of the soil-dwelling *Streptomyces* are known to exhibit multiple tolerances against heavy metals. For example *Streptomyces acidiscabies* E13, isolated from a heavy metal contaminated former uranium mining site, is highly nickel tolerant (up to 10 mM). This bacterium is also capable of precipitating directly or indirectly a new biomineral putatively named nickel struvite $Ni(NH_4)(PO_4)\cdot 6H_2O$ under laboratory conditions [Haferburg et al. (2008)]. The microbial precipitation of such heavy metal containing compounds is considered to be a detoxification mechanism to prevent toxic effects of the heavy metal itself. Remediation processes could use this inducible formation of struvite for the decontamination of heavy metal polluted soils and waste waters.

In this study, new experiments have been performed to test the ability of *Streptomyces acidiscabies* E13 to form related biominerals with other heavy metals (Ba, Cd, Co, Cr, Cu, Mn, Zn). The bacteria were incubated in liquid growth media spiked with heavy metal chlorides. In the course of experiments small sample aliquots were studied with light microscopy. After 2 weeks of incubation at 28°C we observe the formation of polycrystalline spherical (about 50 μm in diameter) aggregeates in experiments with barium, chromium and manganese cations.

The examination of the precipitated crystals was subsequently carried out using analytical TEM, SEM and microprobe techniques. In the experiment with solute barium we observe the precipitation of phosphorous-containing barite. This finding is in agreement with previous laboratory experiments by González-Munõz et al. (2003), observing the formation of barite in the presence of *Myxococcus xanthus*. The incubation of *Streptomyces acidiscabies* E13 with chromium and manganese ions leads however to the formation of a specific magnesium-phosphate comparable to the $Mg_3(PO_4)_2\cdot 4H_2O$ compound synthesized by Kongshaug et al. (2001).

Further control experiments are under way to test whether these crystals would not form in absence of a biological component.

References

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Abs. No. **603**
Meeting: **DMG 2008**
submitted by: **Hopf, Juliane**
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date: **0000-00-00**
Req. presentation: **Poster**
Req. session: **S12**