Amorphous Al hydroxides: a suitable dwelling for microbes

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Thriving in environments of high ionic strength often implies the exposure to mineral precipitation. Mostly the microorganisms themselves trigger this process. As for sulfate reducing prokaryotes, the production of hydrogen sulfide and alkalinity may lead to the formation of metal sulfides as well as Al hydroxides. *Thermodesulfobium* sp. strain 3baa, isolated from acidic mine pit lake 111 in Lusatia, Germany, was shown to form biofilms concomitant to mineral precipitation when grown in artificial pore water medium at low pH. Investigations by confocal laser scanning microscopy and electron microscopy revealed densely populated mineral aggregates despite an apparent lack of extracellular polymeric substances. Cell densities increased from $3.4 \pm 1.6 \cdot 10^6$ in the absence of minerals to $64 \pm 19 \cdot 10^6$ and $289 \pm 150 \cdot 10^6$ cells per cm^2 in the presence of FeS and Al hydroxides, respectively. 90% of the bacteria were estimated to reside within the biofilm with Al hydroxides whereas it was only 50% in FeS crusts and only 10% on bare glass slides. The highest sulfate reducing activity was also observed in the cultures with Al hydroxides. The precipitates were amorphous and consisted mainly of large globules to which the cells firmly attached (Fig. 1). Abiotically produced Al hydroxides by means of NaOH titration were much smaller and did not lead to cell attachment and biofilm formation.

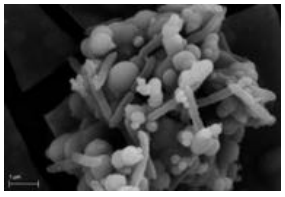

Figure 1: Aggregate of globular Al precipitates and cells of strain 3baa.

This study examplarily shows how minerals may influence activity, growth and mobility of microbes and, vice versa, how microbes may influence the type of minerals forming and, hence, the role they play in sorption processes.