Biotransformation of U(VI) by *Caulobacter crescentus*

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It is well known that microorganisms are able to mediate removal of U(VI) from solution through reduction to insoluble U(IV) oxides under anaerobic conditions, but microbial transformation of U(VI) under aerobic conditions are less well understood. Here, we describe two processes of U(VI) transformation by the aerobic bacterium *Caulobacter crescentus,* known for its ubiquitous presence in aquatic systems and high U(VI) tolerance. U(VI) causes a temporary growth arrest in *Caulobacter* and growth recovery is not due to a decrease in U solubility, a common detoxification strategy employed by other microorganisms. Through functional reporter assays, we discovered that *Caulobacter* is able to reduce U(VI) bioavailability through the secretion of an as-yet unknown, heat-stable metabolite(s), representing a unique U detoxification strategy. Upon recovery from growth arrest, *Caulobacter* proliferates with normal growth kinetics, accompanied by active U(VI) biomineralization. We found that phosphate metabolism is actively involved in the formation of U-P precipitates that are similar to autunite-group minerals. Comparisons of growth and U(VI) precipitation by wild type *versus* a phosphatase mutant indicates that extra-cytoplasmic phosphatase activity is not only responsible for the formation of cell-surface-bound U-P precipitates, but also plays an important role in cell survival under U stress. Our results highlight the importance of aerobic bacterial metabolism for U biogeochemistry.