

Actinobacteria-mediated formation of carbonate minerals

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It is rarely reported about actinomycetes mediated biomineralization. In this work, we investigated carbonate biomineralization mediated by a strain of actinobacteria, *Streptomyces luteogriseus*, a dominant lithophilous actinobacteria isolated from microbial mats on limestone rocks in Puding, Guizhou Province, southwest China. The strain was used to investigate its potential biomineralisation to allow a better understanding of actinobacterial contributions to carbonate mineralisation in nature. Upon completing the actinobacterial cultivation, the ammonium carbonate free-drift method was used with mycelium pellets, the spent culture, and a liquid culture (no visible mycelium pellets). XRD and SEM analyses showed that hexagonal prism calcite was only observed in the sub-surfaces of the mycelium pellets, which is a novel morphology mediated by microbes. Hemispheroidal vaterite appeared in the presence of spent culture, mainly because of the effect of soluble microbial products (SMP) during mineralisation. When using the liquid culture, doughnut-like vaterite was favoured by actinobacterial mycelia, which has not yet been captured in previous studies. Based upon these findings, we propose a mechanism for the *S. luteogriseus* mediated calcite mineralization and conclude that the effects of mycelium pellets as a molecular template almost gained an advantage over SMP both in crystal nucleation and growth, having nothing to do with biological activity. The whole process involves epi- and inter-cellular growth in the local microenvironments whose conditions may be controlled by high pH value, cell sequestration and molecular template in the mineralisation system. It is thereby convinced that lithophilous actinobacteria, *S. luteogriseus*, owing to its special genetic metabolism and filamentous structure, showed good biomineralisation abilities, maybe it would have geoactive potential for biogeochemistry in local microenvironments.