Intracellular calcite and sulfur dynamics of *Achromatium* cells in aerobic incubation experiments

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Giant sulfur-oxidizing bacteria of the genus *Achromatium* are unique in having intracellular calcite granules and sulfur deposits. We investigate how oxygen exposure as a physiological control would affect the dynamics of calcite and sulfur in *Achromatium*. For this purpose, morphological changes and possible accretion mechanisms of calcite granules in cells that were freshly collected from natural Achromatium-containing sediment are compared to cells from the same source after prolonged exposure to atmospheric oxygen. In fresh cells, calcite granules have bumpy surface, irregular shape, and wide blurry boundaries that contain high content of sulfur, compare to the tightly packaged smooth calcite granules with narrow but sharp interstitial space which contains low amount of sulfur in cells that experienced oxygen exposure. These morphological changes indicate changing physiological role of calcite inside *Achromatium* cell. Sulfur oxidation and calcite dissolution appear to be linked in that proton generation during sulfur oxidation is buffered by gradual calcite erosion, visible in the smooth, rounded surface morphology observed after oxygen exposure. Our results support the hypothesis that calcite dynamics buffer the intracellular pH fluctuations linked to electron acceptor limitation during proton-consuming sulfide oxidation to sulfur, and electron acceptor abundance during proton-generating sulfur oxidation to sulfate.