**Introduction:** Both heterotrophic and autotrophic bacteria are known to precipitate various carbonate minerals in marine and freshwater environments. The role of microbiocarbonate precipitation has been demonstrated by microscopy (light and electron), calcification experiments, and carbon isotopic studies. Cyanobacteria and heterotrophic bacteria play an important role in the origin of carbonate muds, microbialites, ooids, and other carbonate structures in marine environments. Most microbiocarbonate precipitation is thought to occur with either cyanobacteria or sulfate-reducing bacteria (SRB). However, it is likely that many other groups of bacteria can also cause the precipitation of carbonate minerals. Previous workers have illustrated the role of SRB, therefore I will not cover SRB’s here. I will focus on our work with unicellular cyanobacteria, more specifically the *Synechococcus* and *Synechocystis* groups. I will also present our current evidence from some, non-sulfate reducing, heterotrophic bacteria isolated from ooids in the Bahamas.

**Results:** Electron microscopic data from *Synechococcus*, *Synechocystis*, and *Vibrio campbelli* illustrates that carbonate minerals precipitate on the cell surface and in the microenvironment surrounding the cell [1]. The microenvironment surrounding bacterial cells is unique from the external aqueous milieu (i.e., seawater). This microenvironment may exhibit an elevated pH value, a higher calcium ion concentration, and an enriched carbon isotopic value due to the cell’s metabolism and/or membrane transport processes [1].

Calcification experiments in the laboratory have shown that the development of microbiocarbonate is usually related to bacterial alkali production which increases the pH of their microenvironment. In the case of unicellular autotrophic cyanobacteria it is the production of OH⁻ ions due to a HCO₃⁻/OH⁻ exchange related to their inorganic carbon uptake for organic biosyntheses [2]. In heterotrophic bacteria the alkali production can be related to ammonia or urea production which alkalizes the microenvironment [3]. Calcification experiments conducted with heterotrophic bacteria isolated from Bahamian ooids show at least three microbes, Pseudoalteromonas sp., Caulobacter sp., and Vibrio campbelli exhibit the ability to alter the pH via alkali production and thereby lowers the calcium ion concentration of sea water, which suggests microbial carbonate precipitation and a contribution to ooid formation.

Carbon isotopic studies, mainly with *Synechococcus* shows that the microbial carbonate produced is highly enriched in $^{13}$C, by approx. 3-4 ‰, relative to the $\delta^{13}$C$_{DIC}$ value of the aqueous milieu. This isotopic enrichment is due to the cyanobacterial fractionation of $^{12}$C for organic biosyntheses. The fractionation results in the microenvironment being enriched in $^{13}$C and therefore the heavy carbonate minerals. Heterotrophic bacteria isolated from ooids show similar microscopic and experimental calcification results. However, carbon isotopic studies of ooids appear to be enriched in $^{13}$C by only approx. 2 ‰. The bacterial community associated with ooids is being identified using isolate and environmental 16S rDNA analyses. Eighteen laboratory isolates have been currently identified and ten environmental clones have been identified which were completely different species from the laboratory isolates. Lastly, many bacteria from carbonate precipitating environments appear to possess an important surface protein or S-layer. These S-layers may help protect the bacteria from their carbonate mineralizing aqueous milieu [3].

**Conclusions:** Microbiocarbonate precipitation is ubiquitous in tropical marine environments and the various mechanism of precipitation are only beginning to be truly understood, especially concerning the diversity of heterotrophic bacteria and their various metabolic capabilities.