Chemical controls on fabric development in non-skeletal carbonates

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Although present-day seawater is saturated in calcite, it does not typically precipitate spontaneously from the water column. This results in large part from the presence of chemical inhibitors in solution [1, and references therein]. Following this logic, late Archean carbonate sediments are thought to reflect the maintainance of high $CaCO_3$ saturation state as a consequence of the presence of inhibitor species [2]. Nucleation of calcium carbonate crystals will eventually occur once prenucleation-stage clusters of the same composition start to form in solution [3]. But if inhibitors are present, they will potentially adsorb onto such clusters, increasing the surface energy of the cluster as a consequence, in turn requiring that the critical cluster size becomes larger (as does the free energy barrier) in order to favour the start of the crystal nucleation process. Importantly, crystal morphology may also be strongly influenced by chemical inhibitors and by saturation state, yet these relationships are not well understood and have not been applied to ancient environments[2].

Here we present the results of constant compostion experiments [4] performed under different inhibitor concentrations and at different supersaturation levels in the presence of calcite crystal seeds. These experiments are intended to test how these parameters may affect overall precipitation rates, and face-specific growth rates, which in turn controls crystalline morphology of the carbonate overgrowths. These experiments will hopefully provide further constraints on the conditions of precipitation of carbonates from alkaline solutions deposited and preserved throughout the geological record and in different geological settings.

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