Role of exopolymers in pelagic barite precipitation in the ocean

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The reliability of pelagic barite as a proxy for productivity and past oceanic conditions has been broadly demonstrated. However, despite decades of research, processes leading to barite precipitation in the undersaturated marine water column have not been clearly identified. Recent experimental work has shown that extracellular polymeric substances are capable of bioaccumulating Ba providing adequate conditions for barite precipitation. These experiments demonstrated that Ba is initially bound to phosphate groups in bacterial cells and exopolymers. Diverse compositions were observed in barite particles formed in laboratory experiments from the initial P-rich precipitates to intermediate phases and the almost complete substitution of phosphate by sulfate, resulting in the formation of barite crystals. Subsequent mineralogical and crystallographic analyses of barite from size-fractionated particulate material from the ocean water column in the Atlantic have also supported this hypothesis by demonstrating that marine barite in the ocean also forms from an initial amorphous P-rich phase that eventually evolves into barite. New studies at other ocean sectors have further supported this mechanism as responsible for pelagic barite formation. Barite particles are commonly associated with exopolymers evidencing that microbial processes and exopolymer production play an essential role in promoting locally high concentrations of Ba and barite precipitation through an amorphous P-rich precursor.