

Origin of rod and dumbbell shaped phosphate precipitates in Namibian shelf sediments

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Microbial processes are thought to play an important role in modern marine phosphogenesis. Sulphur bacteria inhabiting modern shelves act as bacterial “pumps” leading to the phosphate concentrations needed for precipitation of Ca-phosphate minerals such as apatite (Schulz, 2005). Apatite precipitation is highly enhanced in the presence of suitable nucleation templates, such as organic matrices and bacterial ultrastructures.

The microstructure of phosphatic grains from modern Namibian shelf sediments was examined using scanning electron microscopy. The grains are composed of mostly pure Ca-phosphate and are highly porous. The pore walls are largely coated with rod-shaped microstructures of around 1 μm in length and 0.3 μm in diameter which co-occur with an organic matrix. The rods possess consistent shapes and sizes, and are composed of nanocrystallites arranged along the long axis. Superficially, they strongly resemble mineralized microbial cells. However, some morphological features are not consistent with microbial origin. Many of the rods intersect at angles close to 60 or 90 degrees. Together with other microstructures present in the grains, they seem to form a continuum from rods through dumbbells to semi-spherical. Remarkably similar aggregates, called biomimetic fluorapatite-gelatine composites, have been described from laboratory experiments at high supersaturation (e.g. Busch 1999).

Our findings indicate that precaution must be taken while assessing the microbial origin of authigenic precipitates. Nevertheless, the common association of biomimetic apatite composites with organic matrices is consistent with the influence of biological processes on phosphate availability and precipitation.

References:

Busch, S., et. al., 1999. Biomimetic morphogenesis of fluorapatite-gelatin composites: fractal growth, the question of intrinsic electric fields, core/shell assemblies, hollow spheres and reorganization of denatured collagen. *Eur. J. Inorg. Chem.* 10, 1643–53.

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