Microbe-gypsum interactions in microbial mats: implications for the carbonatation of sulfates

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The processes of sulfate reduction and the subsequent replacement of gypsum by calcite may be observed in modern playa-lakes from central Spain, where gypsum and a variety of sulfates are associated with microbial mats. Concentration of Ca^{2+} and SO_4^{2-} in the lake water are typical of gypsum saturated brines that occur in continental environments. Gypsum precipitation takes place upon and within the pigmented phototroph-dominated layers of the microbial mats. Below, in the black layer dominated by sulfate-reducing bacteria the sulfate minerals are extensively corroded. Microscale observations of this layer by conventional (SEM) and environmental scanning electron microscopy (ESEM), energy dispersive X-ray spectroscopy (EDS) and XRD, coupled with light microscopy give evidence of biofilm development on the gypsum surfaces with extensive etching restricted to the area under the attached microorganisms. As a result of this interaction, the colonized surfaces of the sulfates show distinctive pitting, with many etch pits forming in the shape of the rod-shaped microbes, accompanied by chipping and disaggregation features. In addition, calcite and celestite precipitation occurs on the organo-mineral matrix surrounding the etched zones of the sulfate minerals.

The microbe-sulfates interactions in modern microbial mats provide insight into the replacement of solid sulfate by carbonates. This type of pseudomorphic carbonate after gypsum is widespread in ancient evaporitic rocks (Sanz-Montero *et al*.[1]and [2])

[1] Sanz-Montero *et al* (2006) *Journal of Sedimentary Research* **76**, 1257-1266, [2] Sanz-Montero *et al* (2009) *Sedimentary Geology* **222**, 138-148