

Bioinduced formation of bloedite in a shallow saline lake

P. DEL BUEY^{1*}, O. CABESTRERO¹ AND

M.E. SANZ - MONTERO¹

¹ Department of Petrology and Geochemistry, Faculty of Geological Sciences. Complutense University of Madrid. 28040 Madrid, Spain. (*Corresponding author: pablodelbuey@ucm.es)

Seasonal desiccation of Mg^{2+} – (Na^+) – (Ca^{2+}) – SO_4^{2-} – (Cl^-) saline lakes from La Mancha (Central Spain) that host microbial mats led to the precipitation of hydrated Na – Mg sulphates and gypsum. The hydrous mineral phases grow within and in close relation with the benthic microbial mats that thrive at high salinities (up to 400 g·L⁻¹). Sulphates precipitated at the surface of the sediment form thin crusts showing blister morphologies, whilst the evaporites that crystallize submerged, produce continuous biolaminated crusts. Mineralogical, petrographic and high resolution textural studies reveal that the subaqueous crystalline crusts include bloedite, epsomite, gypsum and mirabilite. Bloedite, which represents up to 54 % of the crust, occurs as isolated crystals or clustered with idiomorphic epsomite crystals. Crystals of bloedite, up to 2 mm in size, are seen to nucleate and grow around the gas escape pores within the matgrounds. The growing bloedites incorporate the organic matter into the crystal structure which is responsible for the brownish color they exhibit. In addition, the organic matrix seems to control the characteristic allotriomorphic habit that bloedite precipitates show.

The sulphate crusts grow despite undersaturated values for bloedite (-0.4) and epsomite (-0.6) that were obtained by hydrochemical modelling using PHREEQC. These results suggest that porosity in the matgrounds favours the heterogeneous nucleation of bloedite crystals by providing preferential sites that decrease the nucleation energy barrier. Unlike carbonates, the influence of organic matter on the growth and morphology of the double salt bloedite had not been documented. Therefore, our results provide a new perspective on the formation of hydrated sulphates.

Acknowledgments: We thank to the Spanish Ministry of Economy and Competitiveness (MINECO-FEDER) for financial support (CGL2015-66455-R). The first author thanks Complutense University of Madrid for his Ph.D. grant.