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Microbial weathering of silicates in dolomite-precipitating environments. Miocene lacustrine deposits from the Duero and Madrid Basins, Spain.

M.E. Sanz-Montero and J.P. Rodríguez-Aranda

Departamento Petrología y Geoquímica. Facultad Ciencias Geológicas. Universidad Complutense de Madrid. 28040- Madrid. mesanz@geo.ucm.es

In this paper we describe processes of silicate weathering, which took place coeval with dolomite precipitation in microbial contexts. The features of silicate weathering have been studied in separated dolomite-bearing successions, deposited in mudflat-saline lake systems during the Lower and Middle Miocene in the Madrid and Duero basins, central Spain. Either succession basically consists of dolomite, gypsum, silica and mudstone beds.

In the dolomite beds, fine-sized silicate grains occur associated with the carbonate, whether as interspersed grains or as interdigitated thin layers. The silicate clasts are mainly characterized as quartz, feldspar (mostly K-feldspar) and phyllosilicates (muscovite, illite, biotite, chlorite, smectite). Observations carried out with microscopy techniques reveal that most of the detrital minerals occur coated with biofilms and show different features of alteration. Namely, the quartz grains display surface roughing in the edges. The phyllosilicates, especially the Fe-rich types, have undergone extensive physical disintegration that includes the separation of the layers along the cleavage planes. Besides, these minerals are significantly depleted in Fe, which along with the presence of pyrite precipitates in the vicinity of the altered grains, suggest Fe (III)-reducing bacteria played a role in the weathering of these minerals. The feldspars have also experienced notorious weathering that accounted for the detachment of fragments and the extensive dissolution of the clasts. Subsequently, dissolution products, basically amorphous masses of silica and aluminium, concentrate inside and/or in the closeness of the minerals. Some Ba-Sr sulphates precipitated in the feldspars as a by-

product of the biochemical dissolution.

Based on different evidences, a biological origin in relation to biofilms and microbial mats has been established for the formation of the Miocene dolomite. Primary dolomite formation has been shown to be mainly mediated by sulphate-reducer bacteria under anoxic conditions. This mechanism is consistent with our observations in Miocene deposits. Additionally, the results indicate that the survival of the microbial consortium inhabiting these nutrient-poor environments was considerably guaranteed by silicate solubilization and elemental cycling.