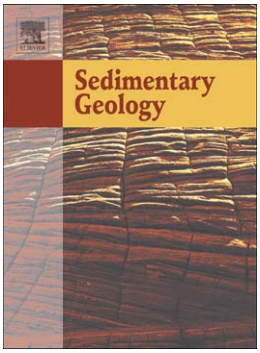

Desiccation cracks in siliciclastic deposits: Microbial mat-related compared to abiotic sedimentary origin

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Desiccation cracks in siliciclastic deposits: Microbial mat-related compared to abiotic sedimentary origin

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Abstract

Siliciclastic sediment colonized by microbial mats yield a set of distinct sedimentary fabrics that are collectively called “mat-related structures (MRS)”. In the rock record, versatile cracks are observed in biostabilized strata, but the mechanisms responsible for their formation remain debated. Microbially stabilized sediments produce desiccation cracks that serve as modern analogues for fossil microbial cracks. However, since both microbial mat shrinkage and clay shrinkage may contribute to the formation of these desiccation cracks, it is difficult to isolate the influence of the microbial mat on the resulting crack formation, distribution and morphology. To address this issue, we conducted a series of desiccation experiments that determine differences between microbially influenced desiccation cracks (i.e. biotic) and those formed in identical, but sterilized (i.e. abiotic) siliciclastic sediment. Three sediment mixtures were used: (1) very fine-sized sand, (2) mixed (ungraded) silt/clay, and (3) normally graded silt/clay. In all of the experiments, the water-rich microbial mat contracted substantially while drying, producing isolated pockets of shallow, but wide cracks, the distribution of which was controlled by heterogeneities in the mat structure and thickness variations of the mat. In the sand-rich substratum, the microbial mat was the only crack-forming mechanism, while in the clay-rich substrata (experiments

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