

Pedogenic Carbonate Biomineralization at the Microbial, Profile, and Ecosystem Scale in Desert Environments

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Pedogenic carbonate is present in many, but not all, desert soils. At the microbial scale, observations with electron microscopy in combination with both lab and field experiments reveal that the formation of pedogenic carbonate is not solely a physicochemical process, but is rather a biogeochemical process in many instances. At the profile scale, the biogenesis of pedogenic carbonate is not apparent with the exception of occasional rhizoliths. Instead, pedogenic carbonate reflects the depth of wetting and shows that progressively older soils have progressively greater morphogenetic amounts of carbonate. At the ecosystem scale, the biogeochemical nature of pedogenic carbonate again becomes apparent with the observation that the driest deserts that are largely barren of vegetation are also largely barren of pedogenic carbonate. This evidence leads to the conclusion that pedogenic carbonate is facultatively induced by organisms when given the prerequisite geochemical environment of Ca^{2+} , pH, CO_2 , and H_2O .