The Effect of Soil Texture on the Precipitation of Pedogenic Carbonate in Semi-Arid Soils

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Calcic horizons are ubiquitous features of soils in the semi-arid Southwest US. Various factors, primarily moisture content, pH and pCO\textsubscript{2}, influence the precipitation of carbonates within the soil profile. Calcium carbonate arrives at the soil surface along with dust, primarily silt and clay, so there is also a systematic increase in the silt and clay content of semi-arid soils with time. The accumulation of calcium carbonate over time produces systematic morphological and textural changes in soils described as stages of calcic horizon development. These changes in soil properties influence the partitioning of precipitation into infiltration and runoff in semi-arid environments. Decreasing water tables and increased societal demands on water supply pose an urgent need to understand the various controls on water movement in thick vadose zones to infer the water balance of the region.

Hydrus 1-D was used to understand how soil texture affects carbonate precipitation with depth in soils of Sevilleta National Wildlife Refuge, New Mexico. Model simulations were run comparing two fine textured soils, a sandy loam and a clay loam exposing them to identical boundary conditions. Meteorological and precipitation chemistry data recorded at Sevilleta Long Term Ecological Research (LTER) Bronco Well site were used as variable boundary conditions. Model results indicate that there is greater accumulation of calcite in soil with the sandy loam texture as compared to soil with the clay loam texture under similar climatic conditions. Sandy soils have higher infiltration rates as compared to clayey soils which accounts for greater accumulation of CaCO\textsubscript{3}. The carbonate horizon is thicker in the sandy loam. The model results support field observations from soil profiles in the Bronco Well areas of Sevilleta where pedogenic carbonate has accumulated in sandy loam textured soils.

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