

Assessing post-Miocene tilting of the Southern High Plains through paleoslope reconstructions of the Ogallala Formation

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The Southern High Plains (SHP) is a physiographic region found in the panhandle of Texas and eastern New Mexico. The SHP is capped by an erosionally resistant caliche soil profile, the Caprock Caliche. Stratigraphy underlying the Caprock Caliche is largely fluvial and eolian deposition representing denudation of the Southern Rocky Mountains and Rio Grande Rift flank during the Miocene forming what is known as the Ogallala Formation. The dimensionless slope of the modern surface of the SHP and the base of the Ogallala Formation are both 0.0018. This slope is on the order of magnitude of proglacial alluvial fans, which do not hold a slope of this magnitude for more than 35 km from their source. Given the concave upward nature of fluvial downstream profiles, slopes should progressively shallow in distances past this 35 km. Deposits of the Ogallala Formation underlying the Caprock caliche are more than 300 km from their source land in the Southern Rocky Mountains. Considering this respective distance down fluvial profile, it seems unlikely that the modern slope is representative of the depositional slope of the Ogallala Formation. Paleoslope reconstructions were employed to estimate the slopes at which Ogallala Formation sediments were deposited at two sites using spatially averaged median grain size and paleoflow depth. Dimensionless depositional slopes were found to be 0.00018 and 0.00015—an order of magnitude less than the modern slopes of the surfaces bounding the Ogallala Formation. This implies the SHP has been tilted post-Miocene. Possible causes of tilting include: 1) recent tectonic activity, 2) isostatic uplift due to crustal heating, and 3) isostatic uplift due to erosion.