Eolian Sediments and Buried Soils

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Buried soils in eolian sediment in South Dakota are found in areas above cliffs, flood plains, and badland basins. What conditions caused the eolian sediment and soils to form? Can buried soils be used to reconstruct conditions at the site? The literature, observations, and buried soil data will be used to propose answers to these questions.

Literature Review

The Oahe formation (Clayton et al., 1976) has four members, each assigned to dated Holocene intervals. Buried soils in these members and in cliff dune sediment (White, 1960) have been interpreted erroneously to represent climatic intervals with above-average precipitation. Eolian sediments require a source area, transporting winds, and a deposition site. Source areas, generally barren or with sparse vegetation, occur in deserts, stream floodplains, cliffs, or areas affected by droughts or fire.

Eolian Materials at Archeological Sites

Shortly after habitation ceased, many archeological sites accumulated eolian sediment that buried and preserved decomposable artifacts. The normal vegetation destroyed by habitation would be reestablished and collect eolian sediments. Loess is deposited preferentially in areas with vegetation (Smith, 1942, p. 163). Miller (1964, p. 149) pictorially reported a fortification ditch filled with a thicker layer of loess than adjacent areas. Lodgement of the loess in the ditch occurred because it was in a wind-sheltered area and probably because tall, ungrazed weeds grew in the ditch. The adjacent area vegetation was too short to collect saltating sediment before it got to the ditch.

Cliff Dunes and Environmental Conditions

Cliff dunes are forming today from sediment blown from the cliff and deposited above the cliff. Cliff dunes are common in the South Dakota White River Badlands where part of the sediment may be from adjacent badland basins that have had most of the unconsolidated material and soils removed by erosion. Gully filling in drier periods has been dated and gully cutting and erosion must have occurred in periods with more precipitation. Currently, gullying is occurring at the same time forests are invading prairie areas in the Black Hills (White et al., 1969) and western Iowa (McComb and Loomis, 1944), which resulted from increased precipitation. Thus gullying, forest encroachment, and cliff dune formation probably occurred when precipitation was greater.

Many badland basins have barren escarpments and cliff dunes around a small part of the basin. Slopes without an escarpment lack overlying cliff dunes, but they may be formed if gullies undercut the slope to create an escarpment. The

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93