VALLEY-SIDE EROSION IN SOUTHERN ILLINOIS

STANLEY E. HARRIS, JR.
Southern Illinois University, Carbondale

Introduction

A steep erosional scarp and accompanying pedimented slope are common features along the sides of valleys in the upland of southern Illinois. These features are actively developing and appear to be of recent origin. The author is initiating a study of these features where accurate measurements of the rate of development can be made. It is hoped that observation of the processes at work will bring a better understanding of slope development.

The characteristics of the phenomenon are as follows:

1. Scarp extends laterally along valley-side more or less parallel to axis of valley.
2. It may "follow contour" but it rises with valley floor; it does not come down to valley floor.
3. Scarp ranges in height from few inches to 15 feet or more.
4. Where higher the feature is generally continuous for several hundred yards, whereas smaller scarps tend to be discontinuous.
5. Higher scarps are generally dissected by steep, short gullies.
6. Gullies seldom extend headward far beyond scarp front.
7. At base of scarp is a gentler erosional slope which may be likened to pediment.
8. Pediment is little dissected, but may have erosional remnants rising above its surface. Slope is nearly straight to concave upward.
9. Slope above scarp rises to upland with convex surface and is rarely dissected by gullies.
10. Scarp and pediment are generally developed in Pleistocene loess deposits. At one high scarp, pebbly glacial till underlying loess forms part of scarp and pediment below. No topographical break occurs at junction of the two materials.

The development of hillside and valley slopes has long been of major interest to geomorphologists, and a number of recent contributions have been made, of which several are cited. Papers by L. C. King (1953), C. D. Holmes (1955), and Czech's translation (1953) of Penck (1924) are particularly stimulating.

First mention of the scarp-and-pedimented-slope feature here discussed appears to have been made by Frye (1954) who described it as "pedimented tributary" valleys or "concavo-convex" gullies. He noted it particularly in the semi-arid plains of western Kansas. Hadley and Rolfe (1955) discussed a similar feature which they called seepage steps. The writer has been interested in this feature since 1950 and has observed it not only in the semi-arid plains where it is actively de-

FIG. 1.—Small scarplet or gravity slope capped by sod in left foreground. Larger continuous scarp in background.

veloping in loess, chalk, and shales, but also in loess and glacial till in the Midwest, and in chalk and sands on the Coastal Plain.

DISCUSSION

The scarplets are best seen in pastureland or abandoned fields where cultivation does not break them down. The typical pastures of southern Illinois do not have a close continuous turf and much bare space is exposed between grass tufts. During heavy rains water courses in a discontinuous sheet down the slope. Grass roots anchor the soil and serve as miniature dams which trap loosened soil particles. The water which flows over and around the grass tufts removes soil from the downslope side, producing a small scarplet from a fraction of an inch to two or three inches high and exposing the roots. Figure 1 shows an eight-inch scarp which has appeared along the hillside just below the principal convexity of the upland; it is believed to represent a coalescence at a critical line of the many miniature scarps.

To date, examination of the small scarps indicates that running water is the main degradational process. However, freezing and thawing, and wetting and drying of the soil raise and loosen particles, thus preparing them for transport, particularly at the time of heavy showers and rapid runoff. There is little evidence of mass wasting in the small scarplets. Slumps and creep were not observed. Once a free face is developed erosion proceeds rapidly.

The surface below the scarp is a wash slope of erosional origin, although it may have a veneer of sediment. It is straight to slightly concave in profile. Close to the foot of the scarp it is generally bare, but downslope it is grass-covered. Commonly a veneer of debris is found here but borings show it to be thin. At the base of higher scarps there are erosional remnants. Ridges and knobs of uneroded areas attest to the lowering of the surrounding parts.

Where the scarps have grown in size to a height of several feet a more complex denudational pattern of sheetwash, rillwash, gullying, slump, and mudslides is indicated (Fig. 2). The entire scarp tends to retreat as a unit, although it may be dissected by many parallel gullies. The gullies do not extend themselves into the upland above the scarp, apparently because the upland waters flow as a sheet on a wash slope.

At the head of the gullies and along the steep scarp, mudslides were observed. Mudslides carry large masses of material from the steep free-face to the waning slope, there to be carried off by running water (Fig. 3). Remnants of mud

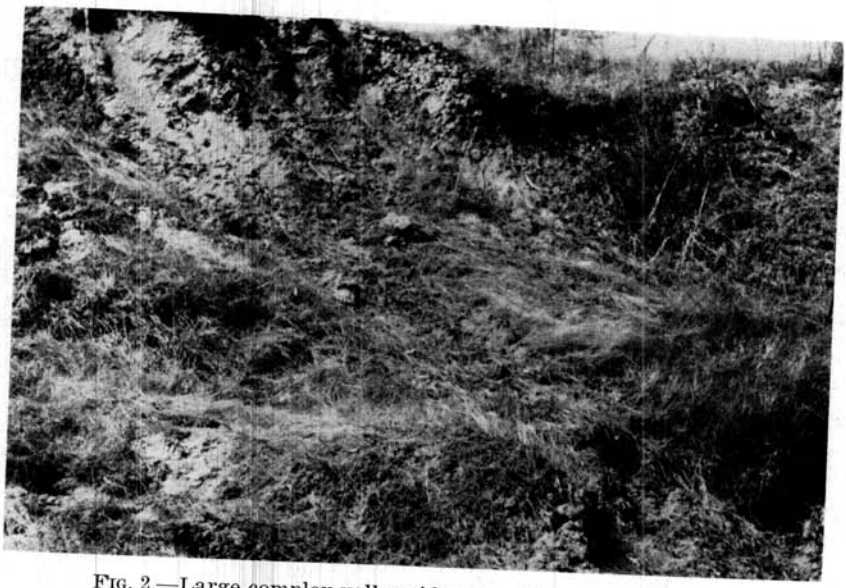

FIG. 2.—Large complex valley-side scarp dissected by gullies.

outline the slide and form a curved ridge at the base. Examination of the source in the loess revealed vertical joints which were opened by wetting and drying and probably also by freezing and thawing. At times of heavy showers water from the upland runs into the joints, saturates the loess, and causes a large slab to fall outward; the mass then slides to the base of the steep slope.

It now appears that the lateral scarp increases in height by retreat into the upland. Lowering of the waning- or wash-slope may also occur as indicated by exposed roots of lespedeza. In places broad-bottomed gullies dissect this slope, invariably containing a series of retreating sod-capped falls.

Examination of the gullies in the scarp reveals that the gully walls also retreat by similar processes. The gully floor soon widens and takes on a gentle, concave cross-profile. The sides then retreat rapidly against the intergully ridge. Sheet wash and rill wash cause rapid retreat, and the gully sides develop a concave profile rising to a rounded, convex, upland surface as in a badlands area. Evidence of rapid denudation is seen in places where lespedeza roots

FIG. 3.—Mud slide on scarp face. Note source area in upper left and path with some debris extending diagonally across photograph to deposit in extreme lower right.

from the previous season are exposed. In the spring of 1957 after a series of heavy rains, the lower branches stood as much as three inches above the ground. Lateral cutting on the gully floor is not a significant process.

Summary

The development of small scarps with a pediment-like wash-slope is a common erosional feature in the Midwest. It appears to be the result of coalescence of many, small, gravity slopes at a critical line below the upland wash-slope. The scarp may grow in size to a formidable topographic feature which retreats rapidly against the upland. Where developed in loess it removes a large segment of the mantling material. A wash-slope of lesser angle develops below it.

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